NHPC LIMITED
(A GOVT. OF INDIA ENTERPRISE)

BID DOCUMENT
(DOMESTIC COMPETITIVE BIDDING – OPEN TENDER)
THROUGH E-TENDERING WITH E – REVERSE AUCTION

FOR

"SETTING UP OF 200 MW SOLAR PV POWER PROJECT IN 600 MW IN SOLAR PARK (STAGE-1) OF GUJARAT STATE ELECTRICITY CORPORATION LTD. (GSECL) AT KHAVDA, GUJARAT."



Tender ID: 2023_NHPC_760763_1

CONTRACTS (CIVIL) DIVISION
REGD. OFFICE: NHPC OFFICE COMPLEX, SECTOR-33, FARIDABAD – 121003

CIN: L40101HR1975GOI032564

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CHECK LIST

Bidders are requested to check the following documents in their submissions prior to submitting their bids:

Sl. No.	***Description***	***Check***	
1	*DD amounting to Rs.20,000/- towards cost of bidding document as mentioned in NIT.*	☐ ***YES***	☐ ***NO***
2	*DD/BG towards Bid security as per ITB*	☐ ***YES***	☐ ***NO***
3	*Certified copy of the partnership deed duly registered, as per ITB, if applicable.*	☐ ***YES***	☐ ***NO***
4	*Power of Attorney along with Board resolution for authorizing the executants for issuing Power of Attorney as per ITB, if applicable.*	☐ ***YES***	☐ ***NO***
5	*Form of Declaration (Annexure-1) duly filled in*	☐ ***YES***	☐ ***NO***
6	*Duly signed Integrity Pact (Annexure-2)*	☐ ***YES***	☐ ***NO***
7	*Duly filled Qualification Information Sheet (Annexure-3A & 3B)*	☐ ***YES***	☐ ***NO***
8	*Form of Declaration of Ineligibility (Annexure-4) duly filled in*	☐ ***YES***	☐ ***NO***
9	*Copies of successful completion certificate(s) of works/assignments*	☐ ***YES***	☐ ***NO***
10	*Annual Reports for last five financial years prior to last date of bid submission.*	☐ ***YES***	☐ ***NO***
11	*Technical Data Sheets duly filled in*	☐ ***YES***	☐ ***NO***
12	*Bid Form duly completed and signed by the Bidder, together with all Attachments as per ITB*	☐ ***YES***	☐ ***NO***

13	*Duly Filled Annexure -8: Process Compliance form for e-RA*	☐ ***YES***	☐ ***NO***
14	*Duly Filled Annexure-9: Price Confirmation form for e-RA*	☐ ***YES***	☐ ***NO***
15	*Form 13 (a) : Deleted*	☐ ***YES***	☐ ***NO***
16	*Attachment-6,6A,7,8,10,11,12,13*	☐ ***YES***	☐ ***NO***
17	*Form 10, 11, 12, 14 to 16*	☐	☐

Note: The Checklist has been framed to facilitate the Bidders so that they may not miss the important inclusion in their bids as well as to facilitate the Employer to avoid delays. Bidders are advised in their own interest to go through entire document thoroughly so that documentation is complete in all respect. Employer shall not be responsible in case the Bidder fails to submit all requisite documents along with its bid.

VOLUME – 0

Notice Inviting Tender (NIT), Bidding Data Sheet

and

Instruction to Bidders (ITB)

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एनएचपीसी लिमिटेड
(भारत सरकार का उद्यम)
NHPC Limited
(A Govt. of India Enterprise)

NHPC Office Complex,
Sector-33, Faridabad-121003

NOTICE INVITING TENDER

(Domestic Competitive Bidding)
(E-TENDERING)

Tender ID: **2023_NHPC_760763_1**

1. Online bids are invited through **Domestic Competitive Bidding in Single Stage-Two Part Bidding** Basis (i.e. Part-I:QR+Technical-Bid and Part-II:Financial Bid) with e-Reverse Auction (e-RA) by NHPC Limited herein after referred to as employer/owner from eligible Bidders for **"Setting up of 200 MW Solar PV Power Project in 600 MW in Solar park (Stage-1) of Gujarat State Electricity Corporation Ltd.(GSECL) at Khavda, Gujarat.**"

   Complete Bid Documents/Tender Document can be viewed and downloaded from Central Public Procurement (CPP) Portal http://eprocure.gov.in/eprocure/app. The site can also be viewed through e-procurement corner of NHPC website www.nhpcindia.com and CPP Portal. Any Bidder who wishes to quote for this Tender can download the Tender Document from aforesaid portal after online Bidder registration for e-tendering. However, the bid is to be submitted online only on http://eprocure.gov.in/eprocure/app up to last date and time of submission of tender. Sale of hard copy of tender document is not applicable.

   E-Reverse Auction (e-RA) shall be conducted after e-tendering. The decision of NHPC regarding adoption of e-RA shall be final.

   THE BRIEF DETAILS OF THE TENDER ARE AS UNDER:

Sl. No.	Item	Description
i)	Mode of tendering	e-procurement System Cover-I: Online Techno-Commercial Bid Cover-II: Price Bid
ii)	Tender ID No.	2023_NHPC_760763_1
iii)	Tender reference No.	NH/CCW/CC-III/CO-258/PR16923/8 dated 28.06.2023.
iv)	Cost of bid document	Rs.20,000/- (Rupees Twenty thousand only) *in the form of demand draft from a Nationalized / Scheduled bank in favour of NHPC Ltd. Payable at Faridabad.*
v)	Bid Security (EMD)	*Rs. 9,20,00,000/-(Rupees Nine CroresTwenty Lakhs only) in the form of DD/BG as per clause No. 14 of ITB.*
vi)	Period of Bid Validity	120 days from the last date of submission of online Bids
vii)	Completion Period	Completion Period of **"Setting up of 200 MW Solar PV Power Project in 600 MW in Solar park (Stage-1) of Gujarat State Electricity Corporation Ltd.(GSECL) at Khavda, Gujarat."** a) **For EPC Part:** from the date of issue of Notification of Award including Commissioning Period is 15 (Fifteen) months. b) **For O&M Part:** Duration of Comprehensive Operation &

		Maintenance is 05 years from the date of commissioning of the project.
viii)	Tender inviting Authority	General Manager (Civil Contracts-III) Room No.-218, 2nd Floor, Jyoti Sadan, NHPC OFFICE COMPLEX, Sector-33, Faridabad-121003, Haryana, India Tele No :+91 (129) 2270596 Email: contcivil3-co@nhpc.nic.in

THE CRITICAL DATES OF TENDER ARE AS UNDER:

S. No.	Particulars	Date & Time
i)	Publishing Date & Time	18.07.2023 (18.30 Hrs)
ii)	Document Download Start Date & Time	18.07.2023 (18.30 Hrs)
iii)	Last date of Reciept of queries /clarification on bid.	28.07.2023 (upto 11:00 Hrs)
iv)	Pre bid meeting Date & Time	01.08.2023 (15:00 Hrs)
v)	Online Bid Submission Start Date & Time	22.08.2023 (11:00 Hrs)
vi)	Online Bid Submission Closing Date & Time	29.08.2023 (17:30 Hrs)
vii)	Last date of Offline submission (date, time and address)	04.09.2023 (upto 17:00 Hrs) **Address**: General Manager (Civil Contracts-III) Room No.218, 2nd Floor, Jyoti Sadan, NHPC OFFICE COMPLEX, Sector-33, Faridabad-121003, Haryana, India Tele No :+91 (129) 2270596 Email: contcivil3-co@nhpc.nic.in
viii)	Opening: Date, Time & Venue of Online/ Offline Bid (Technical Bid (Part-I) submission	06.09.2023 (11.30 Hrs) **Venue**: General Manager (Civil Contracts-III) Room No.214, 2nd Floor, Jyoti Sadan, NHPC OFFICE COMPLEX, Sector-33, Faridabad-121003, Haryana, India Tele No :+91 (129) 2270596 Email: contcivil3-co@nhpc.nic.in
ix)	Price Bid Opening (Part-II) – Financial Bid	Venue, Date & time to be intimated later to the bidders whose Techno-commercial Bids will be found responsive
x)	Date & Time of Start of e-Reverse Auction	Shall be intimated separately by NHPC

2. ELIGIBLE BIDDERS:

2.1 This Invitation for Bid is open in respect of bidders who meet the following conditions:

a) The bidder must be an Indian incorporated legal Entity operating under commercial law of their respective jurisdiction.

b) all bidders meeting the qualification criteria as defined in ITB clause 3.2

2.2 Bidders shall not be under a declaration of ineligibility for corrupt and fraudulent practices by the Employer, any Government institution or Public Sector Undertaking in India in accordance with ITB clause 32.1(a), as on bid submission date.

2.3 The Bidders whose contract(s) have been terminated due to poor performance by the Employer, shall not be allowed to participate in the bidding process for next 5 years w.e.f the date of notification of termination.

2.4 Bidders shall not have been banned/ de-listed/ black listed/ debarred from business on the ground mentioned in para 6 of Guidelines on Banning of Business dealings (Annexure-2A) to Integrity Pact (Annexure-2 of ITB) of Tender Document at the time of submitting the bid and shall intimate immediately of any such banning/de-listing/ black- listed/debarring after submission of bid till the award of the tender. Self-Declaration in this regard is to be submitted as per the proforma enclosed in tender document.

2.5 To qualify for Contract for which bids are invited in the Notice Inviting Tender, the bidder must demonstrate having work experience, financial capability and resources sufficient to meet the aggregate of the qualifying criteria. Failure to produce the certificates and documents in this regard shall make the bid non-responsive.

Even though the bidders meet the qualifying criteria, they are subject to be disqualified if they have made misleading or false representations in the forms, statements, declarations and attachments submitted in proof of the qualification requirements.

3. QUALIFICATION OF THE BIDDER

3.1 All bidders shall include the following information and documents with their bids in Qualification Information unless otherwise stated in the ITB:

a) Written power of attorney of the signatory of the Bid to commit the Bidder. Additional information as sought in the Annexure-3A (Qualification Information Sheets of ITB) shall be provided.

b) Work experience to demonstrate meeting the criteria stipulated in clause 3.2.A shall be provided in Annexure-3 (3B: Qualification Information Sheets).The work experience shown shall be supported with certificate(s) from the Engineer-in-charge/Project head of the concerned work. In case of experience certificate produced by the Contractors for having works for Private Organizations, TDS Certificates shall also be produced along with experience certificate.

c) Information on financial criteria stipulated in clause 3.2 B shall be furnished along with Copy of affidavit/Certificate of CA mentioning Financial Turnover of immediately preceding 3 (three) years. Printed Annual reports or financial statements of the Bidder, such as balance sheet, profit and loss statements and auditor's reports as the case may be for the immediately preceding 5 (five) years shall be submitted to ascertain bidder’s meeting the financial criteria.

d) Time Schedule (as per Appendix-4 of Vol.5: Forms and Procedures).

3.2. QUALIFICATION CRITERIA

The qualification will be subject to Bidder’s fulfillment of the Qualification Criteria set and stipulated hereunder, substantiated by authentic and relevant information and details. Additional information in support of their claims of achievements may be furnished in any form of their device and design. The Bidder(s) who wish to apply for Tender for the aforesaid work must satisfy the following qualifying criteria:

3.2. A The bidder should fulfill Technical Qualifying criteria as mentioned below:

3.2.A.1 The Bidder should have designed, supplied, erected and commissioned Solar Photo Voltaic (SPV) based grid connected power plant(s) of cumulative installed capacity of 40 MW or higher, out of which at least one plant should have been of 10 MW or more.

OR

3.2.A.2 The Bidder should be a developer of Solar Photo Voltaic (SPV) based grid connected power plant(s) of cumulative installed capacity of 40 MW or higher, out of which at least one plant should have been of 10 MW or more.

OR

3.2.A.3(a) The Bidder should have executed in the last ten (10) years either as developer or as EPC Contractor in process industry or in infrastructure development of single work having minimum value of Rs. 150 Crores.

AND

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

The works referred to clause 3.2.A.3 (a) &3.2.A.3 (b) can be in same or different projects.

Notes:

a. The reference SPV based grid connected power plant of 10 MW or higher capacity should be at a single location developed by Bidder for itself or any other client.

b. SPV based Roof-top/Ground mounted/Floating solar power projects, which are grid connected, shall be considered eligible for QR purposes.

c. Bidder shall submit certificate of successful completion and operation from the Owner.

d. In case the award for the reference works has been received by the Bidder either directly from owner of plant or any other intermediary organization, a certificate from such owner of plant or the intermediary organization shall be required to be furnished by the Bidder along with its bid document in support of its claim of meeting requirement stipulated above. Certificate from owner of the plant shall also be furnished by the Bidder for successful operation of the reference plant.

e. Developer means an entity who has either executed or got executed the work/ project as owner of industrial projects.

f. The qualification criteria in Clause 3.2.A.1 or 3.2.A.2 or 3.2.A.3 are mutually exclusive. The bidder has to fulfil any one of the above-mentioned technical eligibility criteria which are individually exclusive.

g. Bidder can also claim the experience of a Group Company/Holding company /Subsidiary Company for meeting the requirement (s) of clause 3.2.A.1 or 3.2.A.2 or

3.2.A.3. In such a case, the Bidder shall furnish an Undertaking jointly executed by the Firm qualified as per Clause 3.2.A.1 or 3.2.A.2 or 3.2.A.3 and the Bidder along with its bid document for complete performance of the Contract (in case of award) jointly or severally, as per the format enclosed in the bid document, failing which, the Bidder's bid document is liable to be rejected.

h. Experience of bidders as EPC Contractor for supply of Balance of System (BOS) items and erection, testing, commissioning of entire solar plant shall be considered.

i. To ascertain the executed value of work for Cl. 3.2.A.3(a), the value of Work experience in INR shall be enhanced on pro-rata basis by 7% simple rate per annum up to the date of Bid Opening from the completion date mentioned in the completion certificate.

3.2.B Financial Criteria

3.2.B.1 Turnover: Average Annual Turnover in the preceding 3 years shall be not less than Rs. 217 Crores.

3.2.B.2 Networth: The Net Worth of the Bidder (s) on the closing day of any 03(three) Financial years out of last 05(five) years should be positive.

'Net Worth' means the aggregate value of the paid-up share capital and all reserves created out of the profits, securities premium account and debit or credit balance of profit and loss 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.

For assessment, relevant pages of Annual Report containing Net Worth figure duly certified by Authorized representative of Bidder, otherwise, figure duly authenticated by the Statutory Auditors should be submitted.

3.2.B.3 Working Capital: The working capital (current assets minus current liabilities) shall be at least Rs. 120 crores.

For this purpose current assets and current liabilities will be considered as classified in the audited balance sheet for the year immediately preceding the date of opening of bids. In case current assets and/or current liabilities are not classified separately in audited Balance Sheet, a certificate from Statutory Auditor/CPA carrying out the Statutory Audit, for current assets and/or current liabilities, as the case may be, clearly defining the items considered for the same, should be enclosed. However, trade payables shall be a part of current liabilities. If the Working Capital calculated from the audited Balance Sheets is negative, then such working capital shall be treated as zero. In case there is a shortfall in the Working Capital as per this,

the unutilized Cash Credit Limits sanctioned to the bidder by the Banks/Financial Institutions of international repute shall be considered to meet the shortfall.

The statement displaying Cash Credit limits should not be more than three months old as on the last date for submission of bids.

Notes:

1. Other income shall not be considered for arriving at Annual Turnover.
2. The Bidder's financial evaluation vis-à-vis the requirement as stipulated above shall be done on the basis of duly printed (offset) Annual Report for the immediately preceding 5 (Five) years submitted by the Bidder along with the Bid. In case, Bid submission date falls upto 30th September, the annual reports upto previous year of immediate preceding Financial Year shall be considered and for the Tenders having Bid submission date after September, the annual reports upto immediate preceding Financial year shall be considered. Further, standalone audited Annual Financial Statement of Bidder forming part of the Annual Report shall only be considered for this purpose.

   In case, if Bidder has not submitted the above Annual Report along with Bid, then a certificate from CEO/CFO of the Bidder shall be submitted along with Bid mentioning that the requirement of Annual Report as per governing law of country is not mandatory. In such cases, duly Self-Certified/Attested copies of Audited Printed Annual Financial Statement (Balance Sheet, Profit & Loss Statement, cash flow statement, Auditor 's Report thereon including all relevant Schedules/ annexures etc.) for the immediately preceding 5(Five) years be submitted by the Applicant along with the Application. The Annual Financial Statement shall be considered for evaluation in same manner as defined in above para for consideration of Annual Reports.

3. Wherever, the Annual Report/ duly self-certified/Attested copies of Audited Printed Annual Financial Statement are in language other than English, then copy duly translated & printed into English language and certified by approved / recognized English translator shall be submitted with the Bid.
4. For the Purpose of compliance to the stipulated turnover criteria given at Financial Criteria, the construction turnover from Joint Ventures(s)/ proposed JV partner (s) as declared in the Joint Venture Agreement shall be considered.

   The proportionate JV Turnover shall be certified by their statutory Auditor in the case of the same not appearing in Audited Financial Statement.
5. The qualification given by Statutory Auditors on the Financial Statements shall be factored appropriately for calculating Net Worth, Turnover and Working Capital etc.

6. In case where financial results for the immediately preceding year are not available, then an statement of account as on closing date of the immediately preceding financial year depicting the Turnover, Net worth (calculated as per laid down criteria) duly certified by their statutory auditor/Certified Public Accountant carrying out the statutory audit shall be enclosed with the bid along with copy of appointment letter of the statutory auditor.
7. For evaluation of financial criteria, Annual Reports of 5 years upto FY 2021-22 shall be considered excluding Financial year 2020-21; being an exceptional year due to outbreak of Covid-19.
8. The statement of account depicting the Turnover and Net Worth should be certified by their Statuory Auditor carrying out the Statutory Audit by generating Unique Document Identification Number (UDIN) as per Gazette Notification No. 1-CA (7)/192/2019 dated 02.08.2019.

3.2. B.4 Bids of any insolvent firm:

The Bidder or partner of JV against whom an application for initiating corporate insolvency resolution process has been admitted by the Adjudicating Authority under the Insolvency and Bankruptcy Code 2016, or as amended from time to time, shall not be eligible for bidding. The same shall also be applicable to the Bidder company, who has taken unconditional technical and/or financial support from their Parent/Holding Company; against whom an application for initiating corporate insolvency resolution process has been admitted by the Adjudicating Authority under the Insolvency and Bankruptcy Code 2016 (IBC 2016), or as amended from time to time.

In case, bidder or JV partner in respect of whom any application for initiating corporate insolvency resolution process was not admitted at the time of submission of bid, but subsequently during the period of evaluation of bids or any time before the work is awarded, any such application is admitted by the Adjudicating Authority under the IBC 2016 (equivalent laws of the country where the firm has been incorporated/registered shall be applicable), the bidder shall be considered as ineligible and his bid shall be rejected.

An Undertaking that “no insolvency proceedings are admitted by the Adjudicating Authority against bidder or partner of JV under the IBC 2016 (equivalent laws of the country where the firm has been incorporated / registered shall be applicable)” shall be submitted on letter head duly signed by the Authorized representative of bidder or all the partners of JV.

Further, the Bidder, after submitting the bid till the time of award of work, shall inform NHPC regarding any admission of application for corporate insolvency resolution process by the Adjudicating Authority under the IBC 2016 against bidder or partner of JV and any suppression of such fact shall render the bidder liable for rejection of his bid and banning of business dealing as per terms and conditions of Guidelines of banning of business dealings under Integrity Pact.

3.3 **Nature of bidders**

Bidder should either be a Single entity or a JV/ Consortium formed for participating in the tendering for this Project.

For evaluation of specific construction experience of various bidders, following criteria shall be considered: -

1. The evaluation of Bidder's Specific Construction experience for a work executed on JV basis shall be based on his role and scope of work in such joint ventures. To establish his role and scope of work in such Joint Venture contracts, the Bidder shall provide documentary evidence such as JV agreement/contract of the work to the extent of experience claimed by him. In case the quantum of work as per experience certificate does not match with the scope of work as defined in the JV/consortium agreement, then the experience credentials shall be considered as per the experience certificate issued by the employer / client.

2. In case scope of work of individual partners is not clearly defined in the JV/consortium agreement then credential of bidder being partner in a JV/consortium shall be decided in the following manner:-

   a. Where specific experience certificate in respect of individual JV partners is available, the same shall be considered to the extent of work executed by such JV partner as per the experience certificate.
   b. Where specific experience certificate is not available, or experience certificate is issued in the name of JV/consortium, the evaluation shall be done in the following manner:-

      1. In case the participation / profit sharing percentage of bidder as per JV agreement is at least 35%, full credit of the work executed by the JV/consortium shall be given to such bidder.
      2. In case the participation / profit sharing percentage of bidder in JV agreement is less than 35%, credit of work executed under such JV shall be given to such bidder on pro-rata basis.
      3. Notwithstanding (i) and (ii) above, in case of availability of specific experience certificate, (a) above shall apply.

   In case both participation share and profit sharing ratio are available in the JV Agreement, participation share shall prevail.

3. For the portion of work executed through a sub-contractor, full experience for that portion of work can be claimed by the Contractor as well as sub-contractor for fulfilling criteria for evaluation of bidder's specific experience.

3.4 **Joint Venture/Consortium Bidders:**

Joint Venture/Consortium Bidders shall comply with the following minimum qualifying requirements:-

i. The number of partners in the Joint Venture not to exceed two (2) with one of the Partners designated as Lead Partner.

ii. The Lead Partner to fully meet the following:-

a. Technical experience criteria as specified in para 3.2.A.1 or 3.2.A.2 or 3.2.A.3.

b. Average annual turnover and Working Capital shall not be less than 50% of the criteria specified in para 3.2.B.1 and 3.2.B.3 respectively.

iii. The other partner to individually meet the following requirements:

- Technical experience criteria as specified in para 3.2.A.1 or 3.2.A.2 or 3.2.A.3.
- Average annual turnover and Working Capital shall not be less than 20% of the criteria specified in para 3.2.B.1 and 3.2.B.3 respectively.

iv. All the partners of the Joint Venture to individually fulfill the Net Worth criteria specified under financial criteria.

v. The Joint Venture to collectively satisfy, as a whole, the Financial as well as Technical requirement specified.

vi. The parties shall be required to form the JV/Consortium before applying for tender which shall be evinced by submitting a copy of the JV/Consortium agreement already entered into for the purpose on Non Judicial stamp paper of appropriate value. The JV/Consortium agreement should contain the role and responsibility of each constituent, the proposed participation share of each partner along with the items of work to be executed by each partner. It shall also be brought out in the JV/consortium agreement that in case the Contract is awarded to the JV/consortium, each partner of the JV/Consortium shall be responsible for execution of that item of work for which he claims to have specific construction experience.

vii. Lead partner of the Joint Venture/Consortium should have at least 50% share. The other Partner of the Joint Venture/Consortium should have at least 10% share.

3.5 Deleted.

3.6 Bids by Merged/ Acquired/ Subsidiary Companies:

In case of a Bidder Company, formed after merger and/or acquisition of other companies, past experience and other antecedents of the merged/acquired companies will be considered for qualification of such Bidder Company provided such Bidder Company continues to own the requisite assets and resources of the merged/acquired companies needed for execution and successful implementation of the work package put to tender.

If the Bidder Company is a Subsidiary Company and applies for tender on the unconditional technical and financial strength of the Parent/Holding Company, the same shall be considered provided the Parent/Holding Company commits to sign a Separate Agreement with NHPC Limited, confirming full support for the Technical and Financial requirements of the Subsidiary Company and commits to take up the works itself in case of non-performance by the Subsidiary Company in the event of award of the works to the Bidder Subsidiary Company. An undertaking by the Parent/ Holding Company to this effect shall be submitted- along with the tender. A Subsidiary Company intending to qualify on the strength of Parent/ Holding Company shall not be allowed to participate as a 'Sub-Contractor'.

For the purpose stated herein above in this clause, 'Parent Company' shall mean the 'Holding Company' owning majority (more than 50%) shares of such Bidder (Subsidiary) Company. Similarly by extensions of this interpretation, if "A" is owned by a 'Holding Company' "B" which in turn is owned by another 'Holding Company' "C", then "C" is construed as the 'Parent Company' of "A" as well as "B" and so on. An apex 'Parent Company' may own number of independent Subsidiary/Group Companies and if any of these Subsidiary/Group Company commits assured support and unhindered access to its assets and resources to another Subsidiary/Group Company (Bidder in this case) under the same apex 'Parent Company' then experience and other credentials of such Subsidiary/Group Company shall be considered for qualification of the Bidder Subsidiary Company provided such commitment is evidenced/ authorized and guaranteed by the apex 'Parent Company'.

The experience of subsidiary companies of the Parent/ Holding Company will be considered experience of the Parent/ Holding Company.

However, for fulfilment of financial criteria, the Bidder's financial evaluation vis-à-vis the requirement as stipulated above shall be done on the basis of consolidated Annual Report for the immediately preceeding 5 (five) years of the Parent Company/ Apex Parent Company submitted by the Bidder along with the Bid/Application.

3.7 Each bidder must also produce with their Bid:

i) PAN No. and EPF Registration No.

ii) GST Registration No.

iii) A declaration that the information furnished with the bid documents is correct in all respects in Annexure-1: Form of declaration

iv) Such other certificates, if any, as defined in the ITB.

3.8 To qualify for Contract for which bids are invited in the Notice Inviting Tender, the bidder must demonstrate having work experience, financial capability and resources sufficient to meet the aggregate of the qualifying criteria. Failure to produce the certificates and documents as required under clause 3.2 shall make the bid non-responsive.

3.9 Even though the bidders meet the above qualifying criteria, they are subject to be disqualified if they have made misleading or false representations in the forms, statements, declarations and attachments submitted in proof of the qualification requirements.

4. TIME FOR COMPLETION

The successful bidder shall complete the entire work within the time specified under S.No.-1(vii) of NIT.

5. Tenders must be accompanied by the Bid Security. The bids not accompanied by the requisite bid security shall be rejected as non-responsive.

6. Deleted

7. PRE-BID MEETING

a) A Pre-bid meeting open to all the prospective bidders will be held on the date mentioned at para 1 above at NHPC Office Complex, Sector-33, Faridabad, wherein they shall be given an opportunity to obtain clarifications, if any, regarding the work and bid conditions.

The bidders may also attend Pre-bid meeting through video conferencing on scheduled date and time or as amended. The bidders who wish to join the meeting through video-conferencing shall intimate Tender Inviting Authority (TIA) at least 02 (two) days prior to pre-bid meeting their details viz. name of participant & designation, mobile no., e-mail address, name of firm or any other information required for video-conferencing. The participant should have good internet connectivity, as TIA shall not be held responsible for any disruption due to internet or any technical issues.

Meeting ID alongwith password shall be shared 01 (one) hour prior to scheduled time to the participant's e-mail/ mobile no. of prospective bidder.

b) Prospective bidders may submit their queries, if any, by email / courier at address of Tender Inviting Authority at least three days before the pre-bid meeting so that the same can be replied during the meeting.

8. BID SUBMISSION

i) Online Bid Submission – Technical Bid (Cover-I) (Refer ITB) and Price Bid (Cover-II) electronic format) complete in all respect must be uploaded at theaforesaid portal by the date & time as per SI. No.1 above.

ii) Offline Bid Submission (Refer ITB) complete in all respect must be delivered in sealed envelopes to the address upto the last date & timeof submission.

In the event of the specified date or amendment, if any, for the submission of bids being declared a holiday for the Employer, the hard copy of the documents will be received up to the specified time on the next working day. Similarly, in the event of the specified date or amendment if any for the opening of bids being declared a holiday for the Employer, the opening shall be carried out at the specified time on the next working day. However, the date and time for online submission of the Bids shall continue to be the date and time specified or amendment if any.

9. The currency for the Bid shall be Indian Rupee only.

10. Bids shall be valid for a period as mentioned in S No. 1 after the deadline for online Bid submission. If any Bidder withdraws his Bid before the said period or makes any modification in his Bid, the bid of such bidder shall be rejected and Bid Security submitted by the Bidder shall be forfeited.

11. The Techno-commercial Bid shall be opened online at venue on the specified date & time as per S.No.-1. The time and date for opening of Financial Bid of bidders qualified in the technical bid shall be communicated to them at later date after evaluation of technical bids. The Employer/Tender inviting Authority at his discretion may open Technical and Financial Bid simultaneously and evaluate the Bid completely.

12. E-tendering: Instruction for online bid submission

The Techno-commercial Bid and Price Bid to be submitted on-line at Central Public Procurement e-Portal http://eprocure.gov.in/eprocure/app. The bidders are required to submit soft copies of their bids electronically on the Central Public Procurement (CPP) Portal, using valid Digital Signature Certificates. The instructions given below are meant to

assist the bidders in registering on the CPP Portal, prepare their bids in accordance with the requirements and submitting their bids online on the CPP Portal.

12.1 Registration:

i) Bidders are required to enrol on the e-Procurement module of the Central Public Procurement Portal by using the "Online Bidder Enrolment" option available on the home page. Enrolment on the CPP Portal is free of charge.

ii) As part of the enrolment process, the bidders will be required to choose a unique username and assign a password for their accounts.

iii) During enrolment/ registration, the bidders should provide the correct/true information including valid email-id & mobile no. All the correspondence shall be made directly with the Consultants/ bidders through email-id provided.

iv) For e-tendering possession of valid Digital Signature Certificate (Class II or Class III Certificates with signing key usage) is mandatory which can be obtained from SIFY/TCS/ nCode/eMudra or any Certifying Authority recognized by CCA India one Token/Smart Card.

v) Upon enrolment on CPP Portal for e-tendering, the bidders shall register their valid Digital Signature Certificate with their profile.

vi) Only one valid DSC should be registered by a bidder. Bidders are responsible to ensure that they do not lend their DSCs to others which may lead to misuse and should ensure safety of the same.

vii) Bidders can then log into the site through the secured login by entering their userID/password and the password of the DSC/ eToken.

12.2 Searching for Tender documents:

a) There are various search options built in the CPP Portal to facilitate bidders to search active tenders by several parameters. These parameters could include Tender ID, Organization Name, Location, Date, Value, etc. There is also an option of advanced search for tenders, wherein the bidders may combine a number of search parameters such as Organization Name, Form of Contract, Location, Date, Other keywords etc. to search for a tender published on the CPP Portal.

b) Once the bidders have selected the tenders they are interested in, they may download the required documents/tender schedules. These tenders can be moved to the respective 'My Tenders' folder. This would enable the CPP Portal to intimate the bidders through SMS/e-mail in case there is any corrigendum issued to the tender document.

c) The bidder should make a note of the unique Tender ID assigned to each tender, in case they want to obtain any clarification/ help from the Helpdesk.

12.3 Preparation of Bids:

a) For preparation of bid, Bidders shall search the tender from published tender list available on site and download the complete tender document and should take into account corrigendum, if any, published before submitting their bids. After selecting the tender document same shall be moved to the **'My Favourite**' folder of bidders account from where bidder can view all the details of the tender document.

b) Bidder shall go through the tender document carefully to understand the documents required to be submitted as part of the bid. Bidder shall note the number of covers in which the bid documents have to be submitted, the number of documents, including the names and content of each of the document that need to be submitted. Any deviations from these may lead to rejection of the bid.

c) Any clarifications if required then same may be obtained online through the tender site or through the contact details given in the tender document.

d) Bidders should get ready in advance the bid documents to be submitted as indicated in the tender document/ schedule in PDF/ xls/ rar/ zip/ dwf formats. If there is more than one document, they can be clubbed together using zip format. Bid documents may be scanned with 100 dpi with black and white option which helps in reducing size of scanned documents.

e) To avoid the time and effort required in uploading the same set of standard documents which are required to be submitted as a part of every bid, a provisionof uploading such standard documents (e.g. PAN card copy, Annual Reports, Auditor Certificates etc.) has been provided to the bidders. Bidders can use "MySpace" or "Other Important Documents" area available to them to upload such documents. These documents may be directly submitted from the "My Space" or "Other Important Documents" area as per tender requirements while submitting the bid and need not be uploaded again and again. This will lead to reduction in the time required for bid submission process.

12.4 Submission of Bids:

i) Bidder should log into the site well in advance for bid submission so that he/ she uploads the bid in time i.e. on or before the bid submission time.

ii) Bidder should prepare the Tender Fee and EMD as per the instructions specified in the NIT/tender document. The originals should be submitted to the Tender Inviting Authority, on or before the last date & time of offline bid submission. The details of the DD/BC/BG, physically sent, should tally with the details available in the scanned copy and the data entered during bid submission time. Otherwise the uploaded bid will be rejected.

iii) While submitting the bids online, the bidder shall read the terms & conditions (of CPP portal) and accepts the same in order to proceed further to submit their bid.

iv) Deleted

v) Bidder shall digitally sign and upload the required bid documents one by one as indicated in the tender document.

vi) Bidders shall note that the very act of using DSC for downloading the tender document and uploading their offers is deemed to be a confirmation that they have read all sections and pages of the tender document without any exception and have understood the complete tender document and are clear about the requirements of the tender document.

vii) Bidder shall note that each document to be uploaded for the tender should be less than 2 MB. If any document is more than 2MB, it can be reduced through zip/rar and the same can be uploaded. For the file size of less than 1 MB, the transaction uploading time will be very fast.

viii) Utmost care shall be taken for uploading Schedule of Quantity & Price and any change/modification of the price schedule shall render it unfit for bidding. Bidders shall download the Schedule of Quantities & Prices in XLS format and save it without changing the name of the file. Bidder shall quote their rates in figures in white background cells, thereafter save and upload the file in financial bid cover (Price bid) only. If the template of "Schedule of Quantities & Prices" file is found to be modified/ tampered by the bidder which tantamount to fraudulent practices and the bid shall be rejected and further dealt as per provision of clause no 32 of ITB including forfeiture of EMD/ BG. The bidders are cautioned that uploading of financial bid elsewhere i.e. other than in cover 2 will result in rejection of the tender.

ix) Bidders shall submit their bids through online e-tendering system to the Tender Inviting Authority (TIA) well before the bid submission end date & time (as per Server System Clock). The TIA will not be held responsible for any sort of delay or the difficulties faced during the submission of bids online by the bidders at the eleventh hour.

x) After the bid submission (i.e. after Clicking "Freeze Bid Submission" in the portal),the bidders shall take print out of system generated acknowledgement number and keep it as a record of evidence for online submission of bid, which will also act as an entry pass to participate in the bid opening.

xi) Bidder should follow the server time being displayed on bidder's dashboard at the top of the tender site, which shall be considered valid for all actions of requesting bid submission, bid opening etc., in the e-tender system.

xii) All the documents being submitted by the bidders would be encrypted using PKI (Public Key Infrastructure) encryption techniques to ensure the secrecy of the data. The data entered cannot be viewed by unauthorized persons until the time of bid opening. The confidentiality of the bids is maintained using the secured Socket Layer 128 bit encryption technology.

Any queries relating to the process of online bid submission or queries relating to CPP Portal in general may be directed to 24x7 CPP Portal Helpdesk.Toll Free **Number 0120-4001-002, 0120-4001-005 and 0120-6277-787.**

13.0 Any corrigendum, subsequent amendments and/or extension of dates, if any, for submission of Bids shall be posted on the portal https://eprocure.gov.in/eprocure/app. Bidder(s) are advised to visit the portal regularly before the deadline for submission of Bids.

14.0 The employer reserves the right to accept or reject any Bid and to cancel the Bidding process and reject all Bids, at any time prior to the award of Contract, without thereby incurring any liability to the affected Bidder or Bidder(s). The Bidder shall bear all costs associated with the preparation and submission of its bid, and the Employer will in no case be responsible or liable for these costs, regardless of the conduct or outcome of the bidding process. However, the Bidder(s) who wish to seek reasons for such decision of cancellation/rejection shall be informed of the same by Employer unless its disclosure reasonably could be expected to affect the sovereignty and integrity of India, the security, strategic, scientific or economic interest of the state or lead to incitement of an offence.

15.0 In case of any difference between wordings of English and Hindi version of 'Notice Inviting Tender', English version shall prevail.

(For & on behalf of NHPC Ltd.)
General Manager (Civil Contracts-III)
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NHPC OFFICE COMPLEX,
Sector-33, Faridabad-121003, Haryana, India
Tele No: +91 (129) 2270596
Email: contcivil3-co@nhpc.nic.in

(I) BIDDING DATA

The following specific data for the Works to be procured shall complement, amend, or supplement the provisions in the Instructions to Bidders (ITB). Whenever there is a conflict, the provisions herein shall prevail over those in Instructions to Bidder:

S. No.	Reference Clause No.	Description	Particulars
1	**1**	**Name of Work**	**Setting up of 200 MW Solar PV Power Project in 600 MW in Solar park (Stage-1) of Gujarat State Electricity Corporation Ltd.(GSECL) at Khavda, Gujarat.**
2	**7**	**Pre-bid meeting: Venue, Date & Time**	Venue: NHPC Ltd., NHPC Office Complex, Sector-33, Faridabad (Haryana). The bidders may also attend Pre-bid meeting through video conferencing on scheduled date and time or as amended. Date: 01.08.2023 Time: 15:00 Hrs
3	**13**	**Bid Validity**	120 days from the last date of submission of online Bid.
4	**14**	**Earnest Money Deposit**	Rs. 9,20,00,000/-(Rupees Nine Crores Twenty Lakhs only).
5	**17**	**Deadline for online submission of bids**	Date:29.08.2023, Time : 17:30 Hrs
6	**17**	**Deadline for offline submission of bids**	Date:04.09.2023, Time : 17:00 Hrs
7	**20**	**Time and Date for opening Technical Bids (online and offline)**	Date :06.09.2023, Time: 11.30 Hrs
8	**24**	**Time and Date of opening Financial Bids**	Shall be intimated separately to Bidders whose Bids are found to be Technically responsive.
9	**24**	**Time and Date of e-RA**	Shall be intimated separately after activity at S.No. 8 above.
10	**33**	**Name of IEM**	1. Sh. Vivek Kumar Johri 2. Dr. Vinod Aggarwal

INSTRUCTION TO BIDDERS

A. INTRODUCTION

1. SCOPE:

Online bids are invited through **Domestic Competitive Bidding in Single Stage-Two Part Bidding** Basis (i.e.Part-I: QR+Technical-Bid and Part-II:Financial Bid) with e-Reverse Auction (e-RA) by NHPC Ltd. herein referred to as employer from eligible **Bidders** for **"Setting up of 200 MW Solar PV Power Project in 600 MW in Solar park (Stage-1) of Gujarat State Electricity Corporation Ltd.(GSECL) at Khavda, Gujarat.**"

The bid will be received, opened and evaluated online in electronic form through NHPC's E-tendering portal i.e. http://eprocure.gov.in/eprocure/app [Link to reach at site is also available at NHPC website i.e., www.nhpcindia.com →e-Procurement→Govt. e-Procurement System of NIC (GePNIC) under Central Public Procurement Portal (CPPP)].

After e-tendering, e-Reverse Auction (e-RA) shall be conducted at application service provider's portal. Bid shall be prepared and submitted in accordance with instructions contained in this Section.

This section of the bidding document provides the information necessary for Bidders to prepare online responsive bids, in accordance with the requirements of the Employer. It also provides information on online bid submission, opening, evaluation, e-Reverse Auction and Contract award.

2. ELIGIBLE BIDDERS:

i. The bidder must be an Indian incorporated legal Entity operating under commercial law of their respective jurisdiction.

ii. Bidders shall not be under a declaration of ineligibility for corrupt and fraudulent practices by the Employer, any Government institution or Public Sector Undertaking in India in accordance with ITB Clause 32.1 (a) of tender document, as on bid submission date.

iii. The Bidders whose contract(s) have been terminated due to poor performance by the Employer, shall not be allowed to participate in the bidding process for next 5 years w.e.f. the date of notification of termination.

iv. Bidders shall not have been banned/ de-listed/ black listed/ debarred from business on the ground mentioned in para 6 of Guidelines on Banning of Business dealings (Annexure-2A) to Integrity (Annexure-2 of ITB) Pact of tender document at the time of submitting the bid and shall intimate immediately of any such banning/de-listing/ black- listed/debarring after submission of bid till the award of the tender. Self-Declaration in this regard is to be submitted as per the proforma enclosed in tender document.

v. Bidders shall meet the qualification criteria as defined in Clause 3.2.

vi. To qualify for Contract for which bids are invited in the Notice Inviting Tender, the bidder must demonstrate having work experience, financial capability and resources sufficient to meet the aggregate of the qualifying criteria. Failure to produce the certificates and documents in this regard shall make the bid non-responsive.

vii. Even though the bidders meet the qualifying criteria, they are subject to be disqualified if they have made misleading or false representations in the forms, statements, declarations and attachments submitted in proof of the qualification requirements.

3. QUALIFICATION OF THE BIDDER

3.1 All bidders shall include the following information and documents with their bids in Qualification Information unless otherwise stated in the ITB:

a) Written power of attorney of the signatory of the Bid to commit the Bidder. Additional information as sought in the Annexure-3A (Qualification Information Sheets of ITB) shall be provided.

b) Work experience to demonstrate meeting the criteria stipulated in clause 3.2.A shall be provided in Annexure-3 (3B: Qualification Information Sheets).The work experience shown shall be supported with certificate(s) from the Engineer-in-charge/Project head of the concerned work. In case of experience certificate produced by the Contractors for having works for Private Organizations, TDS Certificates shall also be produced along with experience certificate.

c) Information on financial criteria stipulated in clause 3.2 B shall be furnished along with Copy of affidavit/Certificate of CA mentioning Financial Turnover of immediately preceding 3 (three) years. Printed Annual reports or financial statements of the Bidder, such as balance sheet, profit and loss statements and auditor's reports as the case may be for the immediately preceding 5 (five) years shall be submitted to ascertain bidder's meeting the financial criteria.

d) Time Schedule (as per Appendix-4 of Vol.5: Forms and Procedures).

3.2. QUALIFICATION CRITERIA

The qualification will be subject to Bidder's fulfillment of the Qualification Criteria set and stipulated hereunder, substantiated by authentic and relevant information and details. Additional information in support of their claims of achievements may be furnished in any form of their device and design. The Bidder(s) who wish to apply for Tender for the aforesaid work must satisfy the following qualifying criteria:

3.2.A The Bidder(s) must satisfy the following technical qualifying criteria:

3.2.A.1 The Bidder should have designed, supplied, erected and commissioned Solar Photo Voltaic (SPV) based grid connected power plant(s) of cumulative installed capacity of 40 MW or higher, out of which at least one plant should have been of 10 MW or more.

OR

3.2.A.2 The Bidder should be a developer of Solar Photo Voltaic (SPV) based grid connected power plant(s) of cumulative installed capacity of 40 MW or higher, out of which at least one plant should have been of 10 MW or more.

OR

3.2.A.3(a) The Bidder should have executed in the last ten (10) years either as developer or as EPC Contractor in process industry or in infrastructure development of single work having minimum value of Rs. 150 Crores.

AND

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

The works referred to clause 3.2.A.3 (a) & 3.2.A.3 (b) can be in same or different projects.

Notes:

a) The reference SPV based grid connected power plant of 10 MW or higher capacity should be at a single location developed by Bidder for itself or any other client.

b) SPV based Roof-top/Ground mounted/Floating solar power projects, which are grid connected, shall be considered eligible for QR purposes.

c) Bidder shall submit certificate of successful completion and operation from the Owner.

d) In case the award for the reference works has been received by the Bidder either directly from owner of plant or any other intermediary organization, a certificate from such owner of plant or the intermediary organization shall be required to be furnished by the Bidder along with its bid document in support of its claim of meeting requirement stipulated above. Certificate from owner of the plant shall also be furnished by the Bidder for successful operation of the reference plant.

e) Developer means an entity who has either executed or got executed the work/ project as owner of industrial projects.

f) The qualification criteria in Clause 3.2.A.1 or 3.2.A.2 or3.2.A.3 are mutually exclusive. The bidder has to fulfil any one of the above-mentioned technical eligibility criteria which are individually exclusive.

g) Bidder can also claim the experience of a Group Company/Holding company /Subsidiary Company for meeting the requirement (s) of clause 3.2.A.1 or 3.2.A.2 or 3.2.A.3 . In such a case, the Bidder shall furnish an Undertaking jointly executed by the Firm qualified as per Clause 3.2.A.1 or 3.2.A.2 or 3.2.A.3 and the Bidder along with its bid document for complete performance of the Contract (in case of award) jointly or severally, as per the format enclosed in the bid document, failing which, the Bidder's bid document is liable to be rejected.

h) Experience of bidders as EPC Contractor for supply of Balance of System (BOS) items and erection, testing, commissioning of entire solar plant shall be considered.

i) To ascertain the executed value of work for Cl. 3.2.A.3(a), the value of Work experience in INR shall be enhanced on pro-rata basis by 7% simple rate per annum up to the date of Bid Opening from the completion date mentioned in the completion certificate.

3.2. B Financial Criteria

3.2.B.1 Turnover: Average Annual Turnover in the preceding 3 years shall be not less than Rs. 217 Crores.

3.2.B.2 Networth: The Net Worth of the Bidder (s) on the closing day of any 03 (three) financial years out of last 05 (five) years should be positive.

'Net Worth' means the aggregate value of the paid-up share capital and all reserves created out of the profits, securities premium account and debit or credit balance of profit and loss 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.

For assessment, relevant pages of Annual Report containing Net Worth figure duly certified by Authorized representative of Bidder, otherwise, figure duly authenticated by the Statutory Auditors should be submitted.

3.2.B.3 Working Capital: The working capital (current assets minus current liabilities) shall be at least Rs. 120 crores.

For this purpose current assets and current liabilities will be considered as classified in the audited balance sheet for the year immediately preceding the date of opening of bids. In case current assets and/or current liabilities are not classified separately in audited Balance Sheet, a certificate from Statutory Auditor/CPA carrying out the Statutory Audit, for current assets and/or current liabilities, as the case may be, clearly defining the items considered for the same, should be enclosed. However, trade payables shall be a part of current liabilities. If the Working Capital calculated from the audited Balance Sheets is negative, then such working capital shall be treated as zero. In case there is a shortfall in the Working Capital as per this, the unutilized Cash Credit Limits sanctioned to the bidder by the Banks/Financial Institutions of international repute shall be considered to meet the shortfall.

The statement displaying Cash Credit limits should not be more than three months old as on the last date for submission of bids.

Notes:

1. Other income shall not be considered for arriving at Annual Turnover.

2. The Bidder's financial evaluation vis-à-vis the requirement as stipulated above shall be done on the basis of duly printed (offset) Annual Report for the immediately preceding 5 (Five) years submitted by the Bidder along with the Bid. In case, Bid submission date falls upto 30th September, the annual reports upto previous year of immediate preceding Financial Year shall be considered and for the Tenders having Bid submission date after September, the annual reports upto immediate preceding Financial year shall be considered. Further, standalone audited Annual Financial Statement of Bidder forming part of the Annual Report shall only be considered for this purpose.

   In case, if Bidder has not submitted the above Annual Report along with Bid, then a certificate from CEO/CFO of the Bidder shall be submitted along with Bid mentioning that the requirement of Annual Report as per governing law of country is not mandatory. In such cases, duly Self-Certified/Attested copies of Audited Printed Annual Financial Statement (Balance Sheet, Profit & Loss Statement, cash flow statement, Auditor 's Report thereon including all relevant Schedules/ annexures etc.) for the immediately preceding 5(Five) years be submitted by the Applicant along with the Application. The Annual Financial Statement shall be considered for evaluation in same manner as defined in above para for consideration of Annual Reports.

3. Wherever, the Annual Report/ duly Self-certified/Attested copies of Audited Printed Annual Financial Statement are in language other than English, then copy duly translated & printed into English language and certified by approved / recognized English translator shall be submitted with the Bid.

4. For the Purpose of compliance to the stipulated turnover criteria given at Financial Criteria, the construction turnover from Joint Ventures(s)/ proposed JV partner (s) as declared in the Joint Venture Agreement shall be considered.

   The proportionate JV Turnover shall be certified by their statutory Auditor in the case of the same not appearing in the Audited Financial Statement.

5. The qualification given by Statutory Auditors on the Financial Statements shall be factored appropriately for calculating Net Worth, Turnover and Working Capital etc.

6. In case where financial results for the immediately preceding year are not available, then an statement of account as on closing date of the immediately preceding financial year depicting the Turnover Net worth (calculated as per laid down criteria) duly certified by their statutory auditor/Certified Public Accountant carrying out the statutory audit shall be enclosed with the bid along with copy of appointment letter of the statutory auditor.

7. For evaluation of financial criteria, Annual Reports of 5 years upto FY 2021-22 shall be considered excluding Financial year 2020-21; being an exceptional year due to outbreak of Covid-19.

8. The statement of account depicting the Turnover and Net Worth should be certified by their Statuary Auditor carrying out the Statutory Audit by generating Unique Document Identification Number (UDIN) as per Gazette Notification No. 1-CA (7)/192/2019 dated 02.08.2019.

3.2. B.4 Bids of any insolvent firm:

The Bidder or partner of JV against whom an application for initiating corporate insolvency resolution process has been admitted by the Adjudicating Authority under the Insolvency and Bankruptcy Code 2016, or as amended from time to time, shall not be eligible for bidding. The same shall also be applicable to the Bidder company, who has taken unconditional technical and/or financial support from their Parent/Holding Company; against whom an application for initiating corporate insolvency resolution process has been admitted by the Adjudicating Authority under the Insolvency and Bankruptcy Code 2016 (IBC 2016), or as amended from time to time.

In case, bidder or JV partner in respect of whom any application for initiating corporate insolvency resolution process was not admitted at the time of submission of bid, but subsequently during the period of evaluation of bids or any time before the work is awarded, any such application is admitted by the Adjudicating Authority under the IBC 2016 (equivalent laws of the country where the firm has been incorporated/registered shall be applicable), the bidder shall be considered as ineligible and his bid shall be rejected.

An Undertaking that “no insolvency proceedings are admitted by the Adjudicating Authority against bidder or partner of JV under the IBC 2016 (equivalent laws of the country where the firm has been incorporated / registered shall be applicable)” shall be submitted on letter head duly signed by the Authorized representative of bidder or all the partners of JV.

Further, the Bidder, after submitting the bid till the time of award of work, shall inform NHPC regarding any admission of application for corporate insolvency resolution process by the Adjudicating Authority under the IBC 2016 against bidder or partner of JV and any suppression of such fact shall render the bidder liable for rejection of his bid and banning of business dealing as per terms and conditions of Guidelines of banning of business dealings under Integrity Pact.

3.3 Nature of Bidders.

Bidder should either be a Single entity or a JV/ Consortium formed for participating in the tendering for this Project.

For evaluation of specific construction experience of various bidders, following criteria shall be considered: -

1. The evaluation of Bidder's Specific Construction experience for a work executed on JV basis shall be based on his role and scope of work in such joint ventures. To establish his role and scope of work in such Joint Venture contracts, the Bidder shall provide documentary evidence such as JV agreement/contract of the work to the extent of experience claimed by him. In case the quantum of work as per experience certificate does not match with the scope of work as defined in the JV/consortium agreement, then the experience credentials shall be considered as per the experience certificate issued by the employer / client.
2. In case scope of work of individual partners is not clearly defined in the JV/consortium agreement then credential of bidder being partner in a JV/consortium shall be decided in the following manner:-

   (a)Where specific experience certificate in respect of individual JV partners is available, the same shall be considered to the extent of work executed by such JV partner as per the experience certificate.

   (b)Where specific experience certificate is not available, or experience certificate is issued in the name of JV/consortium, the evaluation shall be done in the following manner:-

   i. In case the participation / profit sharing percentage of bidder as per JV agreement is at least 35%, full credit of the work executed by the JV/consortium shall be given to such bidder.
   ii. In case the participation / profit sharing percentage of bidder in JV agreement is less than 35%, credit of work executed under such JV shall be given to such bidder on pro-rata basis.
   iii. Notwithstanding (i) and (ii) above, in case of availability of specific experience certificate, (a) above shall apply.

   In case both participation share and profit sharing ratio are available in the JV Agreement, participation share shall prevail.

3. For the portion of work executed through a sub-contractor, full experience for that portion of work can be claimed by the Contractor as well as sub-contractor for fulfilling criteria for evaluation of bidder's specific experience.

3.4 JOINT VENTURE BIDDERS/CONSORTIUM BIDDERS:

Joint Venture/Consortium Bidders shall comply with the following minimum qualifying requirements:-

i. The number of partners in the Joint Venture not to exceed two (2) with one of the Partners designated as Lead Partner.

ii. The Lead Partner to fully meet the following:-

   a. Technical experience criteria as specified in para 3.2.A.1 or 3.2.A.2 or 3.2.A.3.

   b. Average annual turnover and working capital shall not be less than 50% of the criteria specified in para 3.2.B.1 and 3.2.B.3 respectively.

iii. The other partner to individually meet the following requirements:

   - Technical experience criteria as specified in para 3.2.A.1or 3.2.A.2 or 3.2.A.3.
   - Average annual turnover and Working capital shall not be less than 20% of the criteria specified in para 3.2.B.1 and 3.2.B.3 respectively .

iv. All the partners of the Joint Venture to individually fulfill the Net Worth criteria specified under financial criteria.

v. The Joint Venture to collectively satisfy, as a whole, the Financial as well as Technical requirement specified.

vi. The parties shall be required to form the JV/Consortium before applying for tender which shall be evinced by submitting a copy of the JV/Consortium agreement already entered into for the purpose on Non Judicial stamp paper of appropriate value. The JV/Consortium agreement should contain the role and responsibility of each constituent, the proposed participation share of each partner along with the items of work to be executed by each partner. It shall also be brought out in the JV/consortium agreement that in case the Contract is awarded to the JV/consortium, each partner of the JV/Consortium shall be responsible for execution of that item of work for which he claims to have specific construction experience.

vii. Lead partner of the Joint Venture/Consortium should have at least 50% share. The other Partner of the Joint Venture/Consortium should have at least 10% share.

3.5 Deleted

3.6 Bids by Merged/ Acquired/ Subsidiary Companies:

In case of an Bidder Company, formed after merger and / or acquisition of other companies, past experience and other antecedents of the merged / acquired companies will be considered for qualification of such Bidder Company provided such Bidder Company continues to own the

requisite assets and resources of the merged / acquired companies needed for execution and successful implementation of the work package put to tender.

If the Bidder Company is a Subsidiary Company and applies for tender on the unconditional technical and financial strength of the Parent / Holding Company, the same shall be considered provided the Parent / Holding Company commits to sign a Separate Agreement with NHPC Ltd confirming full support for the technical and financial requirements of the Subsidiary Company and commits to take up the work itself in case of non-performance by the Subsidiary Company in the event of award of the work to the Bidder Subsidiary Company. An undertaking by the Parent / Holding Company to this effect shall be submitted along with the tender. A subsidiary company intending to tender on the strength of Parent / Holding Company shall not be allowed to participate as a 'Sub-Contractor'.

For the purpose stated herein above in this clause, 'Parent Company' shall mean the 'Holding Company' owning majority (more than 50%) shares of such Bidder (Subsidiary) Company. Similarly by extensions of this interpretation, if "A" is owned by a 'Holding Company' "B" which in turn is owned by another 'Holding Company' "C", then "C" is construed as the 'Parent Company' of "A" as well as and so on. An apex 'Parent Company' may own number of independent Subsidiary / Group Companies and if any of these Subsidiary / Group Company commits assured support and unhindered access to its assets and resources to another Subsidiary / Group Company (Bidder in this case) under the same apex 'Parent Company' then experience and other credentials of such Subsidiary / Group Company shall be considered for tender of the Bidder Subsidiary Company provided such commitment is evidenced / authorized and guaranteed by the apex 'Parent Company'.

The experience of subsidiary companies of the Parent / Holding Company will be considered experience of the Parent / Holding Company.

However, for fulfillment of financial criteria, financial evaluation vis-à-vis the requirement as stipulated above shall be done on the basis of consolidated printed Annual Report for the immediately preceding 5 (five) years of the Parent Company/Apex Parent Company submitted by the Bidder along with the Bid/Application.

3.7 Each bidder must also produce with their Bid:

i) PAN No. and EPF Registration No. ;
ii) GST Registration No.
iii) A declaration that the information furnished with the bid documents is correct in all respects in Annexure-1: Form of declaration
iv) Such other certificates, if any, as defined in the ITB.

3.8 To qualify for Contract for which bids are invited in the Notice Inviting Tender, the bidder must demonstrate having work experience, financial capability and resources sufficient to meet the aggregate of the qualifying criteria. Failure to produce the certificates and documents as required under clause 3.2 shall make the bid non-responsive.

3.9 Even though the bidders meet the above qualifying criteria, they are subject to be disqualified if they have made misleading or false representations in the forms, statements, declarations and attachments submitted in proof of the qualification requirements.

3.10 To improve transparency and fairness in tendering process the Employer is implementing Integrity Pact as per Clause 33 of this ITB. The bidder must submit the Integrity Pact as per Annexure- 2 duly signed as per clause 33 of ITB.

Pre- contract Integrity Pact is to be executed on plain paper at the time of submission of Bid. The successful bidder (contractor) shall submit duly executed Integrity Pact on non-judicial stamp paper of appropriate value prior to signing of Notification of Award.

To oversee the compliance of obligation under the Integrity Pact, **Sh. Vivek Kumar Johri and Dr. Vinod Aggarwal** has been appointed as Independent External Monitor by the Owner.

The Contact Address of IEMs is as under:-

Sh. Vivek Kumar Johri, 106, Malviya Nagar, Bhopal, MP-462003 e-mail – iem.nhpc@gmail.com	Dr.Vinod Aggarwal, B-103, Sarvodaya Enclave, 2nd Floor, New Delhi – 110 017 e-mail – iem.nhpc@gmail.com

4. COST OF BIDDING

4.1 Complete bid document can be viewed and downloaded from NHPC Limited website www.nhpcindia.com (For reference only) and Central Public Procurement (CPP) Portal http://eprocure.gov.in/eprocure/app/nhpc. The bidder will be required to submit a non-refundable fee of ***Rs.20,000/- (Rupees Twenty thousand only*)** including GST, if applicable, in the form of Crossed Demand Draft in favour of "NHPC Limited" payable at 'Faridabad' towards the cost of Tender fee. The bidder shall fill the tender fee details online and submit same in terms of Clause 16 of ITB on or before the date as specified in "Notice Inviting e-Tender"

4.2 Deleted

Note: Mere downloading of Bid document by prospective Bidder shall not be construed that such a bidder automatically fulfills the prescribed eligibility criteria. Whether the bidder meets the specific eligibility criteria or not, shall be checked or ascertained, on opening their bids by scrutinizing documentary evidences furnished by them along with their bid.

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

5 SITE VISIT

5.1 The tenderers, in their own interest, should inspect and examine the site and its surroundings and satisfy themselves, before submitting their tender, in respect of the site conditions including but not restricted to the following which may influence or affect the work or cost thereof under the Contract:

a) Site conditions including access to the site, existing and required roads and other means of transport/communication for use by the in connection with the works;
b) Requirement and availability of land and other facilities for their enabling works, colonies, stores and workshops etc.
c) Ground conditions including those bearing upon transportation, disposal, handling and storage of materials required for the work or obtained there from;
d) Source and extent of availability of suitable materials including water etc., construction power and labour (skilled and un-skilled) required for work and Laws and Regulations governing their use and employment;
e) Geological, meteorological, topographical, Hydrological and other general features of the site and its Surroundings as are pertaining to and needed for the performance of the work;
f) The limit and extent of surface and sub-surface water to be encountered during the performance of the work and the requirement of drainage and pumping;
g) The type `of equipment and facilities needed, preliminary to, for and in the performance of the work; and
h) All other information pertaining to and needed for the work including information as to the risks, contingencies and other circumstances which may influence or affect the work or the cost thereof under this contract.

5.2 The tenderers should note that information, if any, in regard to the site and local conditions, in these tender documents, except for the material agreed to be supplied by the Employer, if any, has been given merely to assist the tenderers and is not warranted to be complete.

5.3 The tenderers should note and bear in mind that the Employer shall bear no responsibility for the lack of acquaintance of the site and other conditions or any information relating thereto, on their part. The consequences of the lack of any knowledge, as aforesaid, on the part of the tenderers shall be at their risk and cost and no charges or claims whatsoever consequent upon the lack of any information, knowledge or understanding shall be entertained or payable by the Employer

5.4 **ELIGIBLE PLANT, EQUIPMENT AND SERVICES**

For the purposes of these bidding documents, the word ”Facilities” means the plant and equipment to be supplied and installed, together with the services to be carried out by the Contractor under the contract including design. The words “plant and equipment,” ”installation services,” etc., shall be construed in accordance with the respective definitions given to them in the General Conditions of Contract.

B. THE BIDDING DOCUMENTS

6 CONTENT OF BIDDING DOCUMENTS (OR BID DOCUMENTS)

6.1 The Facilities required, bidding procedures, contract terms and technical requirements are prescribed in the bidding documents. The bidding documents include the following sections:

Vol.0 Notice Inviting Tender (NIT), Bidding Data Sheets & Instructions to Bidders (ITB)

Vol.1 Information for Bidders (IFB)

Vol.2 Part A: General Conditions of Contract (GCC)

Part B: Special Conditions of Contract (SCC)

Vol.3 Employer’s Requirements (Technical Specifications)

Vol.4 Technical Data Sheets (TDS)

Vol.5 Forms and Procedures (FP)

6.2 The Bidder is expected to examine all instructions, forms, terms, technical specifications and other information in the bidding documents. Failure to furnish all information required by the

bidding documents or submission 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 its bid.

7 CLARIFICATION OF BIDDING DOCUMENTS & PRE-BID MEETING

7.1 A prospective Bidder requiring any clarification of the bidding documents may notify the Employer in writing or by cable (hereinafter, the term cable is deemed to include telefax or email at the Employer's mailing address indicated in the Invitation for Bids.)

The Employer will respond during Pre-bid Conference to any request for clarification or modification of the bidding documents, if deemed fit,Employer's responsewillbe published on the portal https://eprocure.gov.in/eprocure/app, including a description of the inquiry, but without identifying its source. The Employer shall not be obliged to respond to any request for clarification received later than the above said period. Further, the mere request for clarification from the bidder(s) shall not be a ground for seeking extension in the deadline for submission of bids.

7.2 The Bidder is advised to visit and examine the site where the Facilities are to be installed and its surroundings and obtain for itself on its own responsibility of all information that may be necessary for preparing the bid and entering into a contract for supply and installation of the Facilities. The costs of visiting the site shall be at the Bidder's own expense.

7.3 The Bidder and any of its personnel will be granted permission by the Employer to enter upon its premises and lands for the purpose of such inspection as per 7.2 above, but only upon the express condition that the Bidder and its personnel will release and indemnify the Employer and its personnel 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.

7.4 PRE-BID CONFERENCE:

Pre bid conference will be held as per details specified in 'NIT' where intending bidders may obtain necessary clarifications to their queries, if any, from Employer. All such queries seeking clarification on the bid documents shall be made in writing or by e-mail or facsimile to Tender Inviting Authority at the address indicated in the Bidding Data so as to reach the Employer not later than 3 days before the pre-bid meeting so that the same can be replied during the meeting.

The prospective bidder or his authorized representative may attend the pre-bid meeting as indicated above. The bidders who wish to join the meeting on due date & time through video-conferencing shall intimate Tender Inviting Authority (TIA) at least 02 (two) days prior to pre-bid meeting their details viz. name of participant & designation, mobile no., e-mail address, name of firm or any other information required for video-conferencing. The participant should have good internet connectivity as TIA shall not be held responsible for any disruption due to internet or any technical issues.

Meeting ID alongwith password shall be shared 01 (one) hour prior to scheduled time to the participant's e-mail/ mobile no. of prospective bidder. The purpose of the meeting will be to clarify issues and to answer questions on any matter related to the bid that may be raised at that stage.

The Employer will respond during Pre-bid Conference to any request for clarification or modification of the bidding documents. If deemed fit, written copies of the Employer's response (including an explanation of the query) will be sent after Pre-bid Conference to the respective Bidders who have sought clarification.

Any modifications in the Tender documents listed in Clause 6.1 of ITB, which may become necessary as a result of the pre-bid meeting shall be made by the Employer exclusively through the issue of an Addendum pursuant to Clause 8 of ITB.

Non-attendance at the pre-bid meeting will not be a cause for disqualification of a bidder.

8 AMENDMENT OF BIDDING DOCUMENTS

8.1 At any time prior to the deadline for submission of bids, the Employer may, for any reason, whether at its own initiative, or in response to a clarification requested by a prospective Bidder, amend the bidding documents by issuing Addendum / Corrigendum.

8.2 Any Addendum / Corrigendum thus issued shall be part of the bid documents and shall be posted on E-procurement portal of CPP (http://eprocure.gov.in/eprocure/app) / NHPCwebsite. Bidders are advised to visit the portal regularly before the deadline for submission of bids. The amendments to the bid documents will be binding on the prospective bidders and the notification of the amendment communicated through portal, shall be deemed to be construed that such amendment(s) to the bid documents have been taken into account by the bidder in its application. The responsibility of downloading the related Addendum / Corrigendum, if any, will be that of the bidder. No separate intimation in respect of Addendum / Corrigendum (if any) will be sent to bidder(s)

8.3 In order to afford prospective Bidders reasonable time in which to take the amendment into account in preparing their bid, the Employer may, at its discretion, suitably extend the deadline for the submission of bids and notify throughportal http://eprocure.gov.in/eprocure/app where all prospective bidders may see the extended deadline.

C. PREPARATION OF BIDS

9 LANGUAGE OF BID

The bid prepared by the Bidder and all correspondence and documents related to the bid exchanged by the Bidder and the Employer shall be written in English language, provided that any printed literature furnished by the Bidder may be written in another language, as long as such literature is accompanied by a translation of its pertinent passages in English language, in which case, for purposes of interpretation of the bid, the translation in English shall govern.

10 DOCUMENTS COMPRISING THE BID

10.1 The bid submitted by the Bidder shall comprise the following documents

(a) Bid Form duly completed and signed by the Bidder (without including the quoted price) as provided in Vol. 5 (Form & Procedures) together with all Attachments identified in ITB Sub-Clause 10.2 below.

(b) Price Schedules duly completed by the Bidder in online.

10.2 Each Bidder shall submit with its bid the following attachments:

(a) **Attachment 1: Bid Security**

A bid security furnished in accordance with ITB Clause 14.

(b) **Attachment 2: Power of Attorney**

A power of attorney along with Board resolution for authorizing the executants for issuing Power of Attorney, duly authenticated by a Notary Public, indicating that the person(s) signing the bid has the authority to sign the bid and the bid is binding upon the Bidder during the full period of its validity in accordance with ITB Clause 13.

(c) **Attachment 3: Bidders Eligibility and Qualifications**

The Bidder shall furnish requisite documents / information in support of meeting the qualification requirement as stipulated under ITB clause 2 &3.

(i) General Information Sheet as per **Annexures -3 (A) & 3(B)**
(ii) Notarized copy of Letter of Award (LOA), Agreements and Completion Certificates etc.

In case of certificates being issued by Private Employers, the bidders are required to submit notarized TDS certificate(s) or Form 26AS in respect of works claimed to be executed by the respective bidder(s). The Bidder's financial evaluation as per clause 3.2 B above shall be done on the basis of duly printed Annual Report for the years immediately preceding 5 (Five) years submitted by the Bidder along with the Bid. Further, standalone audited Annual Financial Statement of Bidder shall be forming part of the Annual Report.

(d) **Attachment 4: Eligibility and Conformity of the Facilities and Bidding Documents.**

The documentary evidence of the eligibility of the Facilities shall consist of a statement on origin of the plant and equipment offered, which shall be confirmed by a certificate of origin issued at the time of shipment.

The documentary evidence of the conformity of the Facilities to the Bidding Documents may be in the form of literature, drawings & data, and shall furnish:

i) All the Bidding Documents as per ITB Clause 6.1 duly signed and stamped on each page as a proof of its acceptance except the variation/deviations mentioned in Attachment-6 (without cost of withdrawal) and Attachment-6A (with cost of withdrawal).

ii) all detailed technical information & data and Guaranteed Technical Particulars duly filled in as per the requirement of Technical Data Sheets (Volume-4); and

iii) a list giving full particulars, including available sources, of all spare parts, special tools, etc., necessary for the proper and continuous functioning of the Facilities throughout their life, following completion of Facilities in accordance with provisions of contract.

iv) A list of Tools & Tackles required by the Contractor for Erection/O&M activities of this Project shall be submitted along with the bid for reference purposes. These tools & tackles shall not be required to be supplied to Employer but shall be made available as & when required for Erection / O&M activities of this project (as per Attachment-4A).

Bidders shall note that standards for workmanship, materials and equipment designated by the Employer in the bidding documents are intended to be descriptive (establishing standards of quality and performance) only and not restrictive. The Bidder may substitute alternative standards, brand names and/or catalogue numbers**,** during currency of contract, provided that it demonstrates to the Employer's satisfaction that the substitutions are substantially equivalent or superior to the standards designated in the Employer's Requirements (Technical Specifications).

(e) **Attachment 5: Vendors Proposed by the Bidder**

The Bidder shall preferably supply the components from the "Preferred Make List" at Attachment-5 under heading 'A' (Volume 5: Forms & Procedures).

If the Bidder intends to propose vendors in addition to those indicated in Attachment-5 under heading 'A' he may do so during the currency of contract. The vendors proposed by the bidder shall be BIS/IEC/ASTM/DIN approved and as indicated in Technical Data Sheet (Volume.4). The proposed vendor shall meet the technical requirements as laid down in the Technical Specifications and qualifying requirements (if any) as specified in Attachment-5C.

The Bidder shall furnish the details of the vendor name, nationality and documentary evidences (credentials etc.) during the currency of Contract as per the provisions of

GCC Clause No. 19.1 (Volume-2A). Quoted rates and prices will be deemed to apply to whichever vendor is appointed, and no adjustment of the rates and prices will be permitted.

The Appendix- 5 will be forming part of Contract Agreement.

(f) **Attachment 6: Deviations, if any.**

Deviations, if any, from the terms and conditions or Technical Specifications shall be listed ONLY in Attachment 6 (to be submitted in Techno-commercial cover) to the bid without mentioning its cost of withdrawal. However, all such deviations shall also be mentioned in Attachment 6A along with its cost of withdrawal in the Price Bid . The attention of the Bidders is drawn to the provisions of ITB Sub-Clause 22.1 regarding the rejection of bids that are not substantially responsive to the requirements of the bidding documents.

Bidders' attention is also drawn to the provisions of ITB Sub-Clause 22.5 which requires the bidders to indicate the cost of withdrawal for deviations proposed, if any, failing which cost of withdrawal of such deviations shall be treated as 'NIL'.

Bidders may further note that except for the deviations listed in Attachment 6 and further in Attachment 6A, the bid shall be deemed to comply with all the requirements in the bidding documents and the bidders shall be required to comply with all such requirements of Bidding Documents without any extra cost to the Employer irrespective of any mention to the contrary, anywhere else in the bid.

(g) **Attachment 7:** PERT Network (L2 Schedule). The bidder shall submit a brief integrated PERT Network (L2 Schedule) matching the 'Implementation Schedule' in SCC Clause. No. 9.0.

(h) **Attachment 8**: Detailed Report on Site for Proposed Power Project. The bidder shall submit a report about the proposed site mentioning the brief detail of land.The Bidder shall submit detailed write-up along with data as sought under various sections of the Bidding Documents.

(i) **Attachment 9:** Deleted.

(j) **Attachment 10:** Anti Profiteering Certificate.

(k) **Attachment 11:** HSN / SAC Code for the BOQ Items

(l) **Attachment 12:** Insolvency and Bankruptcy Code 2016

(m) **Attachment 13**: Self Cerificate for Cyber Security as per ITB clause No. 37.

10.3 **BID FORM AND PRICE SCHEDULES**

The Bidder shall complete the Bid Form and the appropriate Price Schedules furnished in the Bidding Documents as indicated therein and in the sub-section "Bid Form and Price Schedules" of the Bidding Documents, following the requirements of ITB Clauses 11 and 12.

11 **BID PRICES**

11.1 Unless otherwise specified in the Employer's Requirements (Technical Specifications), Bidders shall quote for the entire Facilities on a "single responsibility" basis such that the total bid price covers all the Contractor's obligations mentioned in or to be reasonably inferred from the bidding documents in respect of the design, manufacture, including procurement and subcontracting (if any), delivery, construction, installation and completion of the Facilities including supply of Tools & instruments. This includes all requirements under the Contractor's responsibilities for testing and commissioning of the Facilities and, where so required by the bidding documents, the acquisition of all permits, approvals and licenses, etc.; the operation, maintenance and training services and such other items and services as may be specified in the bidding documents, all in accordance with the requirements of the General and Special Conditions of Contract.

11.2 Bidders are required to quote the price for the commercial, contractual and technical obligations outlined in the bidding documents. If a Bidder wishes to make a deviation, such deviation shall be listed in Attachment 6 of its bid. The Bidder shall also provide the price, if any, for withdrawal of such deviations in Attachment 6A.

11.3 Bidders shall give a breakdown of the prices in the manner and detail called for in the Price Schedules or BOQ.

Following Schedules shall be used for each of the following elements:

Schedule No. 1 Schedule of Price for "Supply of Plant & equipment including Specified spares, tools and instruments complete in all respect" for Solar PV Power Plant.

Schedule No. 2 Schedule of price for "Providing Installation, Testing & Commissioning of Plant including Transmission Network including all services i.e storage, handling at Site, including all other Civil Works, Land Development including statutory approval, permits, license etc. complete in all respect" for Solar PV Power Plant.

Schedule No.3 Schedule of Price for "Comprehensive operation and maintenance including all statutory approval, permits, license, testing, caliberation etc. in respect of all the equipment supplied under the First Price Schedule and any other Services specified in the Contract Documents (Second Price Schedule) for 5 years from commissioning of Plant and Annual Maintenance Contract (AMC) of the equipments (hereinafter referred as O&M Schedule).".

Schedule No.4 Grand Summary (Total Sum of Price Schedules 1 to 3 quoted by the bidder) in INR

Schedule No.5 "Total Generation in Units (*for First Year in kWh*)" as quoted by the Bidder.

Schedule No.6 Bid Price per units of Generation i.e. Total Price quoted by the bidder as per Price Schedule – 4 divided by Generation in Units quoted by the Bidder in Price Schedule – 5. The value of Bid Price per units of Generation shall be obtained using spreadsheet calculations.

The Schedules – 1 to 6 shall be submitted in electronic form on the portal. The total amount from each Schedule (1 to3) shall be carried to **Schedule- 4: Grand Total** giving the total bid price(s) to be entered in the Bid Form. Bidders shall note that the plant and equipment included in Schedules Nos.1 above exclude materials used for civil works and other construction works. All materials including consumables required for site storage, erection, testing, and commissioning activities shall be included and priced under Schedule No. 2 stated above.

11.4 In the Schedules, Bidders shall give the required details and a breakdown of their prices as follows:

(a) Plant and Equipment including Transmission Network and Tools & Instruments manufactured or fabricated (**Schedule No. 1**) shall be inclusive of all costs as well as duties and taxes paid or payable on components and raw materials incorporated or to be incorporated in the Facilities.

(b) Providing all Services i.e. Installation, Testing & Commissioning of Plant including Transmission Network including all other Civil Works, Land Development including statutory approvals, permits, license etc. complete in all respect where identified in the bidding documents, as necessary for the proper execution of the Installation Services shall be quoted separately **(Schedule No. 2)**.

(c) Comprehensive Operation & Maintenance charges including all taxes and duties shall be quoted by the Bidder in **Schedule No. 3.**

(d) GST has been implemented by the Government w.e.f 01.07.2017. The Contractor except for the supplies for the categories mentioned at Section 9(3) of GST Act shall submit GSTIN and shall quote his prices in accordance with GST provisions after considering the benefits of Input Tax Credit etc. Undertaking in the prescribed format for passing on benefit of Input Tax Credit and compliance of Anti-profiteering clause under section 171 of CGST Act / SGST Act. Shall be submitted along with bid.

(e) AII applicable taxes /duties as applicable and assessed on the Employer shall also be included in the prices / rates.

(f) **Anti-Profiteering Clause**: As per Clause 171 of GST Act it is mandatory to pass on the benefit due to reduction in rate of tax or from input tax credit to the consumer by way of commensurate reduction in prices. The Supplier of Goods / Services may note the above and quote their prices accordingly. A confirmation to above will also be submitted by contractor as per Attachment-10.

(g) The total amount in INR from each Schedule (1 to 3) shall be carried to Schedule- 4**:** Grand Total, giving the total bid price(s) using spreadsheet calculations.

(h) The "Total Generation in Units (*for First Year in kWh*)", shall be quoted by the Bidder under Schedule -5.

The "Total Generation in Units" as above shall remain unchanged and the bidders shall not be allowed to alter/modify it during entire bidding process including e-Reverse Auction.

(l) Under Schedule –6: Bid Price per units of Generation i.e. Total Price quoted by the bidder as per Schedule –4 divided by Generation in Units quoted by the Bidder in Schedule – 5 shall be obtained using spreadsheet calculations.

11.5 Deleted.

11.6 The Contract price shall remain firm till completion of Contract including Operation and Maintenance for a period of 05 (Five) years from the date of commissioning of Project in accordance with the provisions of Appendix-2 (Price Adjustment).

11.7 Bidders shall apprise themselves with "Conditions for conducting e-RA after e-tendering" and "Business Rules for e-Reverse Auction" enclosed as Annexure-6&7 respectively with this ITB before quoting their prices.

11.8 **Concessional Custom Duty for Solar Photo Voltaic Power Generation Projects:**

As per relevant Notifications of Govt. of India, the benefits of concessional rate of custom duty (applicable for Solar Photo Voltaic Power Generation Projects) may be available for the import of raw materials, components, subassemblies and equipments, if any, required for manufacture of equipment/plant/spares to be supplied under the contract. Bidder may apprise himself of the relevant policies and quote accordingly. The Employer shall issue the requisite certificate as specified in the relevant policy of Govt. of India. However, if the certificate is required to be issued by any department/ministry of government of India or State Government where the Project is located (other than Employer), the Bidder shall itself be responsible for obtaining such certificate from the concerned department/ministry. In such a case, the Employer may issue recommendatory letter to the bidder. To enable the Employer to issue such certificate/recommendatory letter, the Bidder shall furnish the requisite data.

In addition, the Bidder may also like to ascertain availability of Custom Duty benefits available for import of construction equipment, if any, as per the extant Customs Acts & Notifications of Govt. of India. The bidder shall furnish along with their bid, declaration to this effect.

However, the bidders shall themselves be solely responsible for availing such benefits which they have considered in their bid. In case of failure of the bidder to receive the benefits partly or fully from the Govt. of India and/or in case of delay in receipt of such benefits and/or withdrawal of such benefits by the Govt. of India, the Employer shall neither be responsible nor liable in this regard in any manner whatsoever.

12 BID CURRENCIES

Bids shall be furnished in Indian Rupee only.

13 PERIOD OF BID VALIDITY

13.1 Bids shall remain valid for a period as mentioned in Bidding Data after the deadline date for online bid submission specified in Clause 17 of ITB or amendment thereof. A bid valid for a shorter period may be rejected by the Employer as being non responsive.

13.2 In exceptional circumstances, the Employer may solicit the Bidders' consent to an extension of the bid validity period. The request and bidders responses thereto shall be made in writing or by email. If a Bidder accepts to prolong the period of validity, the bid security shall also be suitably extended. A Bidder may refuse the request without forfeiture of its bid security. A Bidder granting the request will not be required nor permitted to modify its bid.

13.3 All the provisions of bid including those regarding discharge and invokation of Bid Security shall continue to apply during the extended period of bid validity specified by the Bidder.

14. BID SECURITY

14.1 Bid shall be accompanied by a bid security /EMD/BG of requisite amount specified in a sealed envelope as stipulated in NIT / Bidding data.

14.2 The bid security shall, at the Bidder's option, be in the form of a crossed Demand Draft in favour of NHPC Limited, Sector–33, Faridabad, Haryana (India) payable at Faridabad or a bank guarantee. The bid security in the form of a bank guarantee and for the amounts expressed in Indian Rupees shall be issued by an Indian Nationalized / Scheduled Commercial Bank. However, the issuing Bank shall submit an unstamped duplicate copy of Bank Guarantees directly to the Employer (Tender Inviting Authority) at the address mentioned at S. No. 1 (viii) of NIT with a forwarding letter.

The format of the bank guarantee shall be in accordance with the form of bid security included in the bidding documents; other formats may be permitted subject to prior approval of the Employer. Bid securities shall remain valid for a period of 90 days, beyond the original validity period of the bid or beyond any period of extension subsequently requested under sub-clause 13.2.

However, in case Earnest Money has been submitted by the bidder in the form of Demand Draft, the information relating to particulars of the bidders' bank shall be submitted by the bidder along with the bid in the ECS form at Section-V. The Earnest Money of unsuccessful bidders shall be remitted by the Employer in the above account through ECS mode.

14.3 Any bid not accompanied by an acceptable bid security shall be rejected by the Employer as being non-responsive.

14.4 Bid Security of bidders who are not qualified for opening of price bid shall be returned within 15 days after such notification. The Bid Security of all the unsuccessful bidders, whose price bid has been opened, will be returned within 15 days of notification of the award of Contract to the successful bidder.

14.5 The bid security of the successful bidder will be returned when the bidder has signed the Contract, pursuant to ITB Clause 30, and has furnished the required performance security,

pursuant to ITB Clause 31.Interest or any other charges, whatsoever, will not be payable by the Employer on bid security amount.

14.6 The bid security may be forfeited under following conditions:

(a) if the Bidder withdraws its bid or varies any terms & conditions without the consent of the Employer, in regard thereto during the period of bid validity or

(b) if the Bidder adopts corrupt or fraudulent or collusive or coercive practices or defaults commitments under Integrity Pact or

(c) in the case of a successful Bidder, if the Bidder fails within the specified time limit

(i) to sign the Contract, in accordance with ITB Clause 30, or

(ii) to furnish the required performance security, in accordance with ITB Clause 31.

(d) If the bidder does not accept the correction of its Bid Price pursuant to ITB Sub-Clause 22.2 or

(e) If the bidder fails to withdraw the deviations listed in Attachment 6 and Attachment 6A at the cost of withdrawal stated by him in thebid in accordance with ITB Clause 22.5.

14.7 Deleted.

14.8 Interest or any other charges, whatsoever, will not be payable by the Employer on the Earnest Money Deposit.

14.9 Deleted.

14.10 Deleted

15. FORMAT AND SIGNING OF BID

The Bid shall be signed /digitally signed for hard copy / online submission, as the case may be by a person duly authorized to sign on behalf of the Bidder as below:

i) If the tender is submitted by an individual, it shall be signed by the individual.

ii) If the tender is submitted by a proprietary firm, it shall be signed by the proprietor.

iii) If the tender is submitted by a firm in partnership, it shall be signed by a partner holding the power of attorney of the firm for signing the tender, in which case a certified copy of the power of attorney shall accompany the tender. A certified copy of the partnership deed duly registered and current business address of all the partners of the firm shall also accompany the tender.

iv) If the tender is submitted by a limited company or a limited corporation, it shall be signed by a duly authorized person holding the power of attorney or any other legally valid document for signing the tender, in which case a certified copy of the power of attorney or any such legally valid document supported by copy of Board Resolution shall accompany the tender. Such limited company or corporation may be required to furnish satisfactory evidence of its existence before the contract is awarded.

v) All witnesses and sureties shall be persons of status and their full names, occupations and addresses shall be stated below their signatures.

D. SUBMISSION OF BIDS

16. SEALING AND MARKING OF BIDS

Bids shall be submitted under single stage two envelope bid through e-tendering as per procedure detailed below. Bidders are to submit various details/ document along with copies of certificates in support of their claims for meeting the qualifying requirements.

In e-tendering Mode:

The bids shall be received through e-tendering Mode as detailed in **Important Instructions to bidders for online bidding.**

PART A – Techno-Commercial Bid

(I) Online Submissions:

The Techno-commercial bid submitted by the bidder in electronic form (online) shall comprise the following documents:

i) Bid Form duly completed and signed by the bidder (without indicating the quoted price) as provided Vol. 5 (Forms & Procedures) together with all Attachments as defined under clause 10 of ITB.

However, Attachment-6A (List of Deviation with cost of withdrawal if any) shall be provided under Price Bids. In the event of non-submission of Attachment -6A, the deviations with Cost of withdrawal (if any) shall be treated as 'NIL'.

ii) Scanned copy of DD/Bank Guarantee shall be as per the format provided at Attachment-1 to Bid Form (Forms & Procedures).

iii) Scanned copy of DD towards cost of bidding document as mentioned in NIT.

iv) Scanned copy of Power of Attorney along with requisite documents as specified under II-Offline Submissions – sl. no .(iii).

v) Scanned copy of duly filled Forms along with supporting documents meeting the qualifying requirements as per clause 3.2 of ITB.

vi) Notarized Copies of successful completion certificate(s) of works/assignments. In addition, in case of these certificates being issued by Private Employers, the bidders are also required to submit notarized Letter of Award / Agreements / TDS certificate(s) etc. in respect of works claimed to be executed by the respective bidder(s).

vii) Scanned copy of duly signed Integrity Pact as per Clause 33 of ITB.

viii) Scanned copy of Attachment-10: Anti-Profiteering Certificate.

ix) Scanned copy of Attachment-11: HSN/SAC Code for the BOQ items.

x) Annual Reports for last five financial years ending on FY 2021-22.

xi) Process Compliance Form for e-RA as per ITB Clause 24.1.

xii) Price Confirmation Form for e-RA as per ITB Clause 24.1.

xiii) Such other certificates / documents as defined in the ITB**.**

xiv) Scanned copy of undertaking on company letter head duly signed by the authorized person as per Attachment 12 in line with Cl. 3.2.B.4 of ITB, as specified under II-Offline Submissions – sl. no .(iv).

xv) Attachment -7- Brief integrated PERT Network (L2 Schedule)

xvi) Attachment 13: Self Cerificate for Cyber Security as per ITB clause No. 37.

The Employer reserves the right to request the bidder for submission of original documents in respect of any of the online submissions defined above.

(II) Offline Submissions (Hard Copies)

Bidders shall submit the following documents duly signed by Authorized signatory in an envelope by the date mentioned in Bidding Data. The envelope received late or after the prescribed due date and time of receipt as mentioned in Bidding Data will not be entertained. NHPC will not be responsible for any postal delay.

i) DD /banker's cheque payable at "Faridabad" (in original) towards cost of bidding document as mentioned in NIT.

ii) DD/BG (in original) towards Bid Security as mentioned in Clause No. 14 of ITB.

iii) Power of Attorney along with Board resolution (original/notarized) for authorizing the executants for issuing Power of Attorney as per Clause 15(iv) of ITB, if applicable. In case of General Power of Attorney, a true copy of the POA shall be duly notarized by Notary and in case of specific Power of Attorney, the original POA.

iv) An undertaking on company letter head duly signed by the authorized person as per Attachment 12 in line with Cl. 3.2.B.4 of ITB.

v) Duly signed Integrity Pact along with its all annexures as per Clause 33 of ITB.

vi) The envelope shall be superscribed as "**Hard Copy of documents for** E- tender No. 2023_NHPC_760763_1, dated ----------".

Out of offline documents, DD towards cost of bid document and DD/BG towards Bid Security must be strictly as per Bid conditions and if any discrepancy is found between the hard copies of the above documents and scanned copy of the same uploaded online, then the Bid uploaded on the portal shall not be considered at all any further. However, Employer may ask for additional documents / clarifications on the other documents submitted online.

Part B) Price Bid

To be uploaded for e-tender

i) The "Price bid" (*Schedule-4: Grand Summary*) along with total price quoted separately in Price Schedules – 1 to 3 is to be submitted in Electronic Form on the portal. Submission of the same by any other means shall not be accepted by the Employer in any circumstances.

ii) The total price quoted separately in Price Schedules -1 to 3 shall be carried to Schedule – 4: Grand Summary and entered in the corresponding schedules listed therein. The value of Grand Summary shall be obtained using spreadsheet calculations.

iii) Attachment 6A in online submission.

iv) The "Total Generation in Units (kWh)", shall be quoted by the Bidder under Price Schedule – 5. The "Total Generation in Units" as above shall remain unchanged and the bidders shall not be allowed to alter/modify it during entire bidding process including e-Reverse Auction.

v) Under Price Schedule – 6 : Bid Price per units of Generation i.e. Total Price quoted by the bidder as per Price Schedule – 4 divided by Generation in Units quoted by the Bidder in Price Schedule – 5 shall be obtained using spreadsheet calculations.

vi) The bidders in their own interest are advised to be very careful while filling up the price bid in Electronic Form.

vii) Bidders will not be allowed to revise the quoted prices on their own, once "Price Bids" have been opened by the Employer.

viii) The bidder shall quote their prices on "Firm basis" in all respects. The bidder shall fill up price bid in Electronic Form considering all applicable taxes & duties as prevailing 28 days prior to last date of submission of Bid.

ix) Bids not covering the entire scope shall be treated as incomplete and hence may be rejected.

x) Price bid of bidders, whose techno-commercial bids are not considered acceptable to the Employer, shall not be opened and will be archived unopened. The decision of the Employer is final and binding in this regard.

xi) Price Schedules 1 to 3 shall be quoted in INR and the Total Generation in Price Schedule-5 shall be quoted in units in kWh.

17. DEADLINE FOR SUBMISSION OF BIDS

a) Complete Bids must be uploaded at the portal and hard copies of the documents mentioned in Clause 16, Part A-II of ITB must be received by the Employer at the address specified in NIT and in bidding data sheet not later than the time and date stipulated in the Bidding Data Sheet or extension thereof. In the event of the specified date for the submission of bids being declared a holiday for the Employer, the hard copy of the documents will be received up to the specified time on the next working day. Similarly, in the event of the specified date or amendment if any for the opening of bids being declared a holiday for the Employer, the opening shall be carried out at the specified time on the next working day. However, the date and time for online submission of the Bids shall continue to be the date and time specified or amendment if any.

b) The Employer may, in exceptional circumstances and at its discretion, extend the deadline for submission of bids by issuing an Addendum / Corrigendum in accordance with Clause 8.1 of ITB, in which case all rights and obligations of the Employer and the bidders previously subject to the original deadline will thereafter be subject to the deadline as extended.

c) The Employer shall not be responsible if bid could not be opened within reasonable time for reasons attributable to the Bidder or for whatsoever reasons. In such a case, the bid shall be sent unopened and 'Archive' on the portal and shall not be considered at all any further and bid security of such bidder may be returned.

18. LATE BIDS

a) Online submission of the bid will not be permitted on the portal after expiry of submission time and the bidder shall not be permitted to submit the same by any other mode.

In such case, even if the bidder has submitted the specific documents in hard copy (viz., DD/BG towards bid security, Duly signed Integrity Pact, Certified copy of the duly registered partnership deed, Balance Sheets and Power of Attorney) within the stipulated deadline, its bid shall be considered as late and shall not be considered at all any further.

Similarly hard copy (ies) of the documents, if received by the Employer after the deadline for submission of Bids prescribed in NIT, then it will be considered as late bid even if the bidder has uploaded the bid within the stipulated deadline. In such a case, the bid uploaded on the portal shall be considered as non-responsive and 'Archived'.The hard copies shall be returned to bidder unopened.

19. MODIFICATION AND WITHDRAWAL OF BIDS

19.1 After submission of the bid the contractor can re-submit revised /modify/substitute or withdraw its bid any number of times but before stipulated deadline for submission of bid.

19.2 In case Employer desired through amendment/corrigendum to submit revised financial bid then it shall be mandatory to submit revised Price bid. In such case the bid submitted before amendment/corrigendum shall become invalid

19.3 The server time (which is displayed on the bidders' dashboard) will be considered as the standard time for referencing the deadlines for submission of the bids by the bidders, opening of bids etc. The bidders should follow this time during bid submission.

19.4 It should be strictly noted that as per portal provisions, the bid once withdrawn by the bidder, the bidder cannot participate in the same tender again.

19.5 No bid can be withdrawn or modified in the interval between the bid submission deadline and the expiration of the bid validity period specified in bid documents. Withdrawal or modification of a bid during this interval will result in forfeiture of its bid security and bid shall be considered non-responsive.

E. BID OPENING AND EVALUATION

20. OPENING OF BIDS BY EMPLOYER

The Employer will open all bids (except the price bid part, which shall be governed as per ITB Clause 16, Part B) in the presence of bidders designated representatives who choose to attend, at the time, date, and location stipulated in the bid document. The bidders' representatives who are present shall sign a register evidencing their attendance. Bidder(s) can also view Bid opening online on the portal https://eprocure.gov.in/eprocure/appat their end.

In the event of the specified date for the opening of bids being declared a holiday for the Employer, the bids will be opened at the appointed time on the next working day.

Initially, the Techno-commercial bid shall be opened and the Price Bid of only those bidders whose Techno-commercial bid is acceptable to the Employer shall be opened online subsequently.

All important information and any such other details as the Employer at his discretion may consider appropriate, will be announced by the Employer at the opening. This shall include but may not be limited to the Bidders' names, the Bid Prices including deviations, withdrawals, bid modifications, and the presence (or absence) of bid security.

21. CLARIFICATION OF BIDS

21.1 During bid evaluation, the Employer may, at its discretion, ask the Bidder for a clarification of its bid. The request for clarification and the response shall be in writing or email or through the portal, and no change in the price or substance of the bid shall be sought, offered or permitted. Reply shall be submitted by Bidder within a stated reasonable period of time. If Bidder does not provide clarifications of the information requested by the date and time set in the Employer's request for clarification, its Bids may be rejected.

22 PRELIMINARY EXAMINATION OF BIDS

22.1 The Employer will examine the bids to determine whether they are complete, whether any computational errors have been made, whether required sureties have been furnished, whether the documents have been properly signed, and whether the bids are generally in order. The Employer will, thereafter check and ascertain whether the bidder fulfils the Eligibility Criteria and other requirements specified under ITB clause 3. The Bids submitted by the Bidders who meet the Eligibility Criteria set under ITB clause 3 shall only qualify for consideration and further techno-commercial evaluation by the Employer.

22.2 The Price Bid duly filled in excel sheet in conformity with the tender specification shall be uploaded on the e-procurement portal only. Unit of Measure (UOM) is indicated in the BOQ. The BOQ is to be filled in by filling rates of the items to be filled in by the Bidder. The calculation of amount by multiplying the quantities with the rates filled in by the bidder, sub-totals, total etc. shall be done by formulae already provided in electronic form. In case of any discrepancy in the calculations, the rates shall be considered final and the amount calculated by using the same shall be corrected and considered as final. Where ever prices for items are left blank, in the BOQ, it shall be deemed to have been included in other items. Confirmation in respect of correction of errors to be sought only from the Lowest Evaluated Bidder, in case these corrections do not change the inter-se position of the Bidders. In case these corrections

change the inter-se position of the Bidders, then confirmation shall be sought from those Bidders, whose inter-se position get changed on account of these corrections. If the Bidder does not accept the correction of errors as above, its bid will be rejected and the bid security will be forfeited in accordance with ITB sub-clause 14.6(d).

22.3 The Employer may waive any minor infirmity, nonconformity or irregularity in a bid that does not constitute a material deviation, whether or not identified by the Bidder in Attachment - 6 to its bid, 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 Clauses 23 and 24.

Also, if any discrepancy is found between the hard copies of the online documents viz. DD/BG towards Bid Security, Power of Attorney and scanned copy of same uploaded which tantamount to fraudulent practice by the bidder, then the online bid shall be liable for rejection.

22.4 Prior to the detailed evaluation, the Employer will determine whether each Bid is prima facie complete and is substantially responsive to the Bidding Documents. For purposes of this determination, a substantially responsive Bid is one that conforms to all the terms, conditions and specifications of the Bidding Documents without material deviations, objections, conditionality or reservations. A material deviation, objection, conditionality or reservation is one (i) that affects in any substantial way the scope, quality of performance of the Contract; (ii) that limits in any substantial way and/or is inconsistent with the Bid Documents or the Employer's rights or the successful Bidder's obligations under the Contract; or (iii) whose rectification would unfairly affect the competitive position of other Bidders who are presenting substantially responsive Bids.

22.5 In particular, Bids with deviations from, objections to or reservations on provision such as those concerning Bid Security/EMD, Bid validity, Defects Liability, Indemnity and on provisions mentioned below, if any, will be treated as non-responsive.

Bids containing deviations from critical provisions relating to GCC Clause 5 (Governing Law), 6 (Settlement of Disputes), 12 (Terms of Payment), 13.3 (Performance Security), 14 (Taxes and duties), 26.2 (Completion Time Guarantee), 27 (Defects Liability), 28 (Functional Guarantees), 29 (Patent Indemnity), 30 (Limitation of Liability), ITB Clause 32 (Corrupt or Fraudulent Practices), ITB Clause 33 (Integrity Pact) and Price Adjustment as per Appendix-2 (Forms & Procedures) will be considered as non-responsive.

However, the bidders wishing to propose deviations to any of the provisions other than those mentioned above, must provide in the Attachment-6 without cost of withdrawal and in Attachment 6A of the bid with cost of withdrawal of such deviations. If such deviations are not priced, cost of withdrawal of such deviations shall be treated as ‘NIL’. The evaluated cost of the bid shall include, in addition to the costs described in ITB Clause 24, the cost of withdrawal of the deviations from the above provisions to make the bid fully compliant with these provisions.

Before Award of Contract, if so desired by the Employer, the bidder shall withdraw these deviations listed in Attachment 6 and Attachment 6A at the cost of withdrawal stated by him in the bid. In case the bidder does not withdraw the deviations proposed by him, if any, at the cost of withdrawal stated by him in the bid, his bid will be rejected and his bid security forfeited.

The Employer's determination of a bid's responsiveness is to be based on the contents of the bid itself without recourse to extrinsic evidence.

22.6 If a bid is not substantially responsive, it will be rejected by the Employer, and may not subsequently be made responsive by the Bidder by correction of the nonconformity.

22.7 The Bid shall also be examined / evaluated on National Defence & Security considerations of the country where the site is located. The Employer reserves the right to set aside / reject the bid on these considerations.

23. TECHNO-COMMERCIAL EVALUATION

The Employer will carry out a detailed evaluation of the bids previously determined to be substantially responsive in order to determine whether the technical aspects are in accordance with the requirements set forth in the bidding documents. In order to reach such a determination, the Employer will examine and compare the technical aspects of the bids on the basis of the information supplied by the bidders, taking into account the

(a) Overall completeness and compliance with Employer's requirements deviations from the Employer's requirements as identified in Attachment 6 to the bid; and quality, function and operation of any process control concept included in the bid. The bid that does not meet minimum acceptable standards of completeness, consistency and detail will be rejected for non-responsiveness.

(b) Achievement of specified performance criteria by the Facilities

(c) Type, quantity and long-term availability Specified and Recommended spare parts and maintenance services

(d) Any other relevant factors, if any, listed in the Bid Document or that the Employer deems necessary or prudent to take into consideration.

(e) "Generation in Unit" quoted by the Bidder considering the target generation shall be submitted alongwith the Technical Bid as per format attached as "MONTHWISE RADIATION & GENERATION" with Chapter-2 of Volume 4 "Technical Data Sheets" of Bid Documents.

The minimum value of quoted Generation by the bidders shall remain unchanged and the bidders shall not be allowed to alter/modify it during entire bidding process including e-Reverse Auction.

24. PRICE BID EVALUATION

24.1 (i) Price bids of only qualified and techno-commercially responsive bidders shall be opened.

(ii) Price evaluation of the bids shall be carried out with following considerations, subject to e-reverse auction:

a) Supply cost of **Plant & equipment including Specified spares, tools and instruments complete in all respect** as per Price Schedule No. -1.

b) Installation, Testing & Commissioning of Plant including Transmission Network including all other Civil Works, Land Development including statutory approvals, permits, license etc. complete in all respect as per Price Schedule- No. 2.

c) Total Price for comprehensive O&M for 05 *years* quoted in Price Schedule No.3

d) Price Schedule – 4: Grand Summary comprising Total of Price Schedule 1 to 3.

e) Total Estimated energy generation (*for First Year in kWh*) quoted by the bidder in Price Schedule - 5.

(The decision of the Employer regarding evaluation of Annual Estimated Generation proposed by different bidders shall be final and binding on the bidders)

f) Under Price Schedule -6, Bid Price per units of Generation i.e. Total Price quoted by the bidder as per Price Schedule – 4 divided by Generation in Units quoted by the Bidder in Price Schedule – 5 shall be obtained using spreadsheet calculations.

g) The Employer's Price evaluation of a bid will take into account the bid prices indicated in Price Schedule No. 1, 2, 3, 4, 5 & 6, and cost of withdrawal of deviations, if any, indicated in Attachment No. 6 A .In case, no cost of withdrawal is mentioned against any deviation(s) indicated in the Attachment No. 6 & 6A, the same will be treated as 'Nil'.

h) The other deviations and omissions not identified as deviations in Attachment No. 6 & 6A shall neither be considered for cost compensation nor for evaluation but these deviation shall have to be withdrawn by the bidder at no extra cost to the Employer.

i) Rebates (discounts) offered, in any form of bid proposal or on the forwarding letter shall not be taken cognizance under any circumstances.

iii). Bid price of the bidder shall be calculated as stipulated in ITB Clause 24.1.(ii) for deriving the Bid Price per units of Generation, e-Reverse Auction shall be carried out as per the procedure defined in Part-III of ITB comprising the following:-

i. Conditions of conducting e-RA after e-tendering (enclosed as Annexure-6)
ii. Business Rule for e-RA (enclosed as Annexure-7)
iii. Process Compliance form for e-RA (enclosed as Annexure-8)
iv. Price Confirmation form for e-RA (enclosed as Annexure-9)

During e-Reverse Auction, if no bid is received with in specified time, the Employer at its discretion may decide to close the e-Reverse Auction process and proceed with results of e-tendering. The decision regarding e-RA by NHPC shall be final and binding on all the bidders.

The Bidders are advised in their own interest to take utmost care while filling prices in the Price Bid (Schedule- 4: Grand Summary) and individual Schedule 1 to 6, wherever applicable.

The Price Bid duly filled in spreadsheet in conformity with the tender specification shall be uploaded on the e-procurement portal only. Unit of Measure (UOM) is indicated in the BOQ. The BOQ is to be filled in by filling rates of the items to be filled in by the Bidder. The calculation of amount by multiplying the quantities with the rates filled in by the bidder, sub-totals, total etc. shall be done by formulae already provided in electronic form. In case of any discrepancy in the calculations, the rates shall be considered final and the amount calculated by using the same shall be corrected and considered as final.

Where ever prices for items are left blank, in the BOQ, it shall be deemed to have been included in other items.

24.2 Technical and commercial evaluation of the Tenders will be carried out for the eligible Bidders on the basis of completeness and conformity with respect to the tender requirements. The Price bid of bidders, whose Techno-commercial bids are not found eligible by the Employer, shall not be opened and will be archived unopened. The decision of the Employer is final and binding in this regard.

25. Deleted

26. CONTACTING THE EMPLOYER

26.1 Subject to ITB Clause 21, no Bidder shall contact the Employer on any matter relating to its bid, from the time of the opening of bids to the time the contract is awarded.

26.2 Information relating to the examination, clarification, evaluation, and comparison of bids and recommendations for the award of a contract shall not be disclosed to bidder(s) or any other persons not officially concerned with such process until the award to the successful Bidder has been announced. Any effort by a Bidder to influence the Employer in the Employer's bid evaluation, bid comparison or contract award decisions may result in rejection of the Bidder's bid.

F. AWARD OF CONTRACT

27. AWARD CRITERIA

27.1) a) Subject to Clause 28, the Employer will award the contract to the successful bidder whose bid has been determined to be substantially responsive as per the

"Conditions for conducting e-RA after e-tendering" which is enclosed as per Part - III to the ITB. The Employer may request the substantially responsive lowest evaluated bidder to attend the pre-award discussions / Post Tender Negotiations (PTN), if required.

b) The mode of contracting with the successful bidder will be as per stipulation outlined in relevant GCC/SCC Clauses and briefly indicated below:

Setting up of 200 MW Solar PV Power Project in 600 MW in Solar park (Stage-1) of Gujarat State Electricity Corporation Ltd.(GSECL) at Khavda, Gujarat.

c) Entire responsibility with regard *to* **"Setting up of 200 MW Solar PV Power Project in 600 MW in Solar park (Stage-1) of Gujarat State Electricity Corporation Ltd.(GSECL) at Khavda, Gujarat.**" will remain with Contractor and the Contractor shall coordinate all activities for smooth and timely completion of the project.

27.2 The Employer may request the Bidder to withdraw any of the deviations listed in Attachment 6 to the winning bid, at the price shown for the deviation in Attachment 6A to the bid. Bidder would be required to comply with all other requirements of the Bidding Documents except for those deviations which are accepted by the Employer.

27.3 During e-Reverse Auction, if no bid is received within specified time, the Employer at its discretion may decide to close the e-Reverse Auction process and proceed with results of e-tendering. In such a situation, in case of discrepancy between the price quoted in Price Bid (Schedule-4: Grand Summary) and individual Price Schedules 1 to 3, the lesser of the amount(s) quoted in Price Schedule(s) 1 to 3and quoted against Price Bid (Schedule- 4: Grand Summary) and evaluated price shall be considered at the time of award of work to the lowest bidder and shall be considered to arrive at Contract Price.

28. EMPLOYER'S RIGHT TO ACCEPT ANY BID AND TO REJECT ANY OR ALL BIDS

The Employer 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 for any reason including National Defence & Security conditions of the country where the site is located without thereby incurring any liability to the affected Bidder or bidders.

The Bidder shall bear all costs associated with the preparation and submission of its bid, and the Employer will in no case be responsible or liable for these costs, regardless of the conduct or outcome of the bidding process However, the bidders who wish to seek reasons for such decision of cancellation / rejection shall be informed of the same by Employer unless its disclosure reasonably could be expected to affect the sovereignty and integrity of India, the security, strategic, scientific or economic interest of the State, relation with foreign State or lead to incitement of an offence.

29. NOTIFICATION OF AWARD

29.1 Prior to the expiration of the period of bid validity, the Employer will notify the successful Bidder in writing by registered letter/ speed post / fax, that its bid has been accepted. The notification of award will constitute the formation of the contract and will be considered for all purposes of execution of contract provisions till such time the signing of the Contract Agreement except as per provisions of Clause 30 of ITB.

29.2 Upon the successful Bidder's furnishing of the performance security pursuant to ITB Clause 31, the Employer will promptly notify the other bidders that their bids have been unsuccessful.

29.3 The unsuccessful Bidders shall also be informed simultaneously about their status of Bids on the tender portal.

30. SIGNING OF CONTRACT AGREEMENT

After notifying the successful bidder that its bid has been accepted, the Employer will prepare the Contract Agreement as per Format provided in Volume 5: Forms & Procedures, incorporating all the correspondence exchanged between the parties, which have a bearing on the Contract.

Within 28 days of receipt of notice of readiness of the Contract Agreement by the Employer, the Employer and the successful bidder shall sign the Contract Agreement after submission of Performance Security in terms of ITB Clause 31. Till signing of Contract Agreement between Employer and successful bidder, provisions under Clause-6.3 (Arbitration) of GCC shall not be applicable.

31. PERFORMANCE SECURITY

31.1 Within twenty-eight (28) days after receipt of the notification of award, the successful Bidder shall furnish the requisite performance security for an amount equivalent to 3% of the Contract Price as per GCC clause 13.3 and in the form provided in the section "Forms and Procedures" of the Bidding Documents or in any other form acceptable to the Employer. In case of a Joint Venture, the Performance Bank Guarantee shall be in the name of individual partner of Joint Venture in proportion of its participation share. The performance security shall not be released till liquidated damages, if any, is pending for recovery.

If the contractor does not submit the performance security within the stipulated period due to any valid reason, Tender Inviting Authority may grant time extension for submission of performance security based on the request of contractor.

In case, the contractor does not submit performance security without a valid reason, the Employer shall impose simple interest @12% per annum on the full amount of applicable performance security (alongwith applicable taxes, if any) for the period of delay in submission of performance security. The interest on delayed period shall be calculated on pro rata basis for number of delayed days.

The interest accrued shall be payable by the Contractor within 14 days from the date of intimation by Tender Inviting Authority in form of Bank Demand Draft/ Banker Cheque in favour of 'NHPC Ltd', otherwise the same shall be recovered from any payment due or become due against bills / any other amount lying with NHPC.

The delayed submission of Performance Security by the Contractor shall be recorded in substantial completion and final completion certificates. Further, no claim for extension of time for completion period or any other type of claim on account of delayed submission of performance security shall be entertained.

31.2 If contractor fails to submit the Performance Security within 45 days (for the contracts having time for completion - upto 12 months) or 60-days (for the contracts having time for completion - more than 12 months) from the date of issue of Letter of Award (LOA), then following actions shall be taken against such Contractor:

(i) Award shall summarily be terminated

ii) EMD/ Bid security shall be forfeited.

iii) The bidder shall be debarred / banned to participate in the business dealings with NHPC for a period of one year.

iv) The name of the Contractor shall be hosted on the NHPC website etc. as per existing norms of NHPC / Govt. of India.

v) Such defaulted contractor shall not be eligible to participate in the bidding process of re-tender of this work.

31.3 Bidders shall communicate the following bank details of NHPC to the issuing Bank for online confirmation of Bank Guarantee to be submitted in terms of Clause 14 of ITB and Performance Security to be submitted in terms of Clause 31 of ITB:

Name of the beneficiary: NHPC Ltd.
Account No.: 10813608692
IFSC Code: SBIN0017313
Address of the Bank: State Bank of India,
5th Floor, Redfort Capital, Parsvnath Towers, Bhai Veer Singh Marg, Gole Market, New Delhi-110001.

32. CORRUPT OR FRAUDULENT OR COLLUSIVE OR COERCIVE PRACTICES

32.1 It is expected from the Bidders / suppliers / contractors that they will observe the highest standard of ethics during the procurement and execution of such contracts. In pursuance of this policy:

(a) for the purposes of this provision, the terms set forth below shall mean as under:

i) "**Corrupt practice**" means the offering, giving, receiving or soliciting directly or indirectly of anything of value to influence the action of a public official in the procurement process or in contract execution; and

ii) "**Fraudulent practice**" means a misrepresentation/omission of facts in order to influence a procurement process or the execution of a contract to the detriment of the Employer, 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 Borrower of the benefits of free and open competition;

iii) "**Collusive Practice**" means a scheme or arrangement between two or more bidders, with or without the knowledge of Employer, designed to establish bid prices at artificial, non-competitive levels.

iv) "**Coercive Practice**" means harming or threatening to harm, directly or indirectly, person or their property to influence their participation in a procurement process or affect the execution of Contract.

(b) An agreement called Integrity Pact between the prospective bidders and the Employer shall be signed committing the persons / officials of both the parties, not to exercise any corrupt influence on any aspect of the Tender / Contract. The Independent External Monitor(s) (IEM) appointed by Employer shall oversee the compliance of obligation under the Integrity Pact.

(c) A Bid may be rejected by the Employer if it is determined at any stage that the respective Bidder has engaged in corrupt or fraudulent or collusive or coercive or undesirable or restrictive practices or default commitment under Integrity Pact in competing for the contract in question.

(d) The Employer may declare a firm ineligible, either indefinitely or for a stated period of time, if it at any time determines that the firm has engaged in corrupt or fraudulent or collusive or coercive practices in competing for or default commitment under Integrity Pact or in executing the contract.

e) **Banning of Business Dealings:** It is not in the interest of NHPC to deal with Agencies who commit deception, fraud or other misconduct in the tendering process. The grounds on which Banning of Business Dealings can be initiated are as follows:

i) If the security consideration, including questions of loyalty of the Agency to NHPC so warrants;

ii) If the director/owner of the Agency, proprietor or partner of the firm, is convicted by a court of law for offences involving moral turpitude in relation to its business dealings with the Government or any other public sector enterprises, during last five years;

iii) If the Agency has resorted to Corrupt, Fraudulent, Collusive, Coercive practices including misrepresentation of facts and violation of the any provisions of the Integrity Pact provided in the Contract.

iv) If the Agency uses intimidation / threatening or brings undue outside pressure on NHPC or its official for acceptance / performances of the job under the contract:

v) If the Agency misuses the premises or facilities of the NHPC, forcefully occupies or damages the NHPC's properties including land, water resources, forests / trees or tampers with documents/records etc.

vi) If the Agency does not fulfill the obligations as required under the Contract and Violates terms & conditions of the contract which has serious affect for continuation of the Contract.

vii) If the work awarded to the agency has been terminated by NHPC due to poor performance of the contract in the preceding 5 years.

viii) If the Central Vigilance Commission, Central Bureau of Investigation or any other Central Government investigation Agency recommends such a course in respect of a case under investigation or improper conduct on agency's part in matters relating to the Company (NHPC) or even otherwise;

ix) On any other ground upon which business dealings with the Agency is not in the public interest.

x) If business dealings with the Agency have been banned by the Ministry of Power, Government of India OR any PSU/ any other authority under the MOP if intimated to NHPC or available on MOP Website, the business dealing with such agencies shall be banned with immediate effect for future business dealing except banning under Integrity Pact without any further investigation.

(Note: The examples given above are only illustrative and not exhaustive. The Competent Authority may decide to ban business dealing for any good and sufficient reason).

The procedure for banning of Business Dealings shall be governed as per NHPC's "Policy and Procedure for Banning Business Dealings". This policy is published in NHPC website under Integrity corner.

32.2 Furthermore, Bidders shall be aware of the provision stated in Sub-Clause 42.2 of the General Conditions of Contract and return their bid security as per Clause 14.4 of ITB.

33. INTEGRITY PACT

To improve transparency and fairness in the tendering process the Employer is implementing Integrity Pact.

The Integrity Pact, signed by all the prospective Bidders and the Employer, shall commit the persons/officials of both the parties, not to exercise any corrupt/ fraudulent/collusive/coercive practices in the Tendering process and also during implementation of the Contract. All Applicants shall enter into an Integrity Pact (to be executed on plain paper) with the Employer at the time of submission of their Bids. Only those Bidders who have entered into Integrity Pact with the Employer shall be eligible to participate in the bidding process. Entering into Integrity Pact as per Performa provided in the Section Forms & Procedure is a basic qualifying requirement.

The Integrity Pact digitally signed on behalf of the Employer is provided as per Annexure-2 in ITB. The Integrity Pact shall be downloaded, printed and signed by the Applicant and the hard copy shall be submitted.

Successful bidder shall submit duly executed Integrity pact on Non-Judicial Stamp paper of appropriate value prior to signing of Contract Agreement.

To oversee the compliance of obligation under the Integrity Pact, **Sh. Vivek Kumar Johri** and **Dr. Vinod Aggarwal** has been appointed as Independent External Monitor (IEM) by the Employer. The Contact address of IEMs is as under:

Sh. Vivek Kumar Johri, 106, Malviya Nagar, Bhopal, MP-462003 Email : iem.nhpc@gmail.com	Dr.Vinod Aggarwal, B-103, Sarvodaya Enclave, 2nd Floor, New Delhi – 110 017 Email : iem.nhpc@gmail.com

34. Procurement from countries sharing land border with India

a) Any bidder from a country which shares a land border with India (except to which the Government of India has extended line of credit or in which the Government of India is engaged in development projects as mentioned in Order Public Procurement No. 2 dt. 23.07.2020 or its subsequent revisions/amendments) will be eligible to bid only if the bidder is registered with the Competent Authority, i.e. Registration Committee constituted by DPIIT.

b) The successful bidder shall not be allowed to sub contract works to any contractor from a country which shares a land border with India (except to which the Government of India has extended line of credit or in which the Government of India is engaged in development projects as mentioned in Order Public Procurement No. 2 dt. 23.07.2020 or its subsequent revisions/amendments) unless such contractor is registered with the Competent Authority, i.e. Registration Committee constituted by DPIIT.

c) A bidder is permitted to procure raw material, components, sub assemblies, etc. from the vendors of countries sharing a land border with India without getting registered with the Competent Authority, i.e. Registration Committee constituted by DPIIT, as it is not regarded as "sub contracting".

d) However, in case a bidder proposes to supply finished goods procured directly/indirectly from the vendors of the countries sharing land border with India, such vendors will be required to get registered with the Competent Authority, i.e. Registration Committee constituted by DPIIT.

Procurement of spare parts and other essential service support like Annual Maintenance Contract (AMC) / Comprehensive Maintenance Contract (CMC), including consumables for closed systems, from Original Equipment Manufacturers

(OEMs) or their authroised agents, shall be exempted from the requirement of registration as mandated under Rule 144(xi) of GFRs 2017.

35. Public Procurement (Preference to Make in India) Order

Definitions:

Local Content: means the amount of value added in India which shall, unless otherwise prescribed by the Nodal Ministry, be the total value of the item procured (excluding net domestic indirect taxes) minus the value of imported content in the item (including all custom duties) as a proportion of the total value, in percent.

In case of items having sufficient local capacity and local competition, local content equal to or more than 50% shall be allowed only. The list of items having sufficient local capacity and local competition shall be as per Ministry of New & Renewable Energy order no. F. No. 283/22/2019-GRID SOLAR dated 23.09.2020 and its further revisions**.**

Class-I local supplier: means a supplier or service provider, whose Goods/ services/ Works offered for procurement, has local content equal to or more than 50%.

Class-II local supplier: means a supplier or service provider, whose Goods/ services/ Works offered for procurement, has local content equal to or more than 20% but less than 50%

Non Local Supplier: means a supplier or service provider, whose Goods/ services/ Works offered for procurement, has local content equal to or less than 20%.

Margin of purchase preference: means the maximum extent to which the price quoted by a 'Class-1 local supplier' may be above the L-1 for availing purchase preference. The margin of purchase preference shall be 20%.

Works: means all works as per Rule 130 of GFR-2017, and shall also include Turnkey works, Engineering, Procurement & Construction (EPC) Contracts and Services include System Integrator (SI) contracts.

Eligibility Criteria for Class I / II and Non Local Suppliers.

a) For procurement of Goods/Services/Works, irrespective of purchase value where there is sufficient local capacity and local competition, only Class-I local supplier shall be eligible to bid.

b) For procurement of Goods/Services/Works, not covered under a) above and having estimated value less than INR 200.00 Crore, Global tender enquiry shall not to be issued except with the approval of Competent Authority as designated by Department of Expenditure. Only Class-I and Class-II local suppliers shall be eligible to bid in procurements, except when Global tender enquiry has been issued. In Global tender enquiries, Non-local suppliers shall also be eligible to bid alongwith Class-I and Class-II local suppliers.

The above criteria shall be subject to compliance of following:

i) The bidder shall have to be an entity registered in India in accordance with law. Indian subsidiaries of foreign bidders are eligible to participate in the bidding

process provided they meet the qualifying criteria in terms of capability, competency, financial position, past performance etc. Further, Foreign bidders shall compulsorily set up their manufacturing units on a long term basis in India.

ii) Foreign bidders can also participate in the bidding process provided they form Joint Venture with any bidder registered in India in accordance with law.

iii) Country of origin of the equipment/material shall be provided in the bid.

iv) The bids shall be in Indian National Rupees (INR) only in respect of local content.

v) The bidder shall follow Indian laws, regulations and standards.

vi) For supply of equipment / material from the country of origin other than India, the bidder shall submit performance certificate in support of satisfactory operation in India or a country other than the country of origin having climatic and operational conditions including ambient temperature similar to that of India for minimum one year.

vii) The manufacturer/ supplier shall list out the products and components producing Toxic E-waste and other waste. It shall have an Extended Producers Responsibility (EPR) so that after the completion of the lifecycle, the materials are safely recycled / disposed of by the Manufacturer/ Supplier and for this, the Manufacturer/Supplier along with procurer has to establish recycling / disposal unit or as may be specified.

viii) The bidder shall have to furnish a certificate regarding cyber security/safety of the equipment / process to be supplied/services to be rendered as safe to connect.

ix) Wherever required, the Foreign supplier shall establish fully functional service centers in India and shall keep spares/material locally for future needs of Utilities.

x) Arbitration proceedings shall be instituted in India only and all disputes shall be settled as per applicable Indian Laws.

Procedure for Purchase Preference

a) Subject to the provisions of this Order and to any specific instructions issued by the Nodal Ministry or in pursuance of this Order, purchase preference shall be given to "Class-I local supplier" only in procurement undertaken by procuring entities in the manner specified here under.

b) In the case of procurement of **goods / works**, which are **divisible in nature**, the 'Class-I local supplier' shall get purchase preference over 'Class-II local supplier' as well as 'Non-local supplier', as per following procedure(not applicable in this tender):

(i) Among all qualified bids, the lowest bid will be termed as L1. If L1 is 'Class-I local supplier', the contract for full quantity will be awarded to L1.

(ii) If L1 bid is not a 'Class-I local supplier', 50% of the order quantity shall be awarded to L1. Thereafter, the lowest bidder among the 'Class-I local supplier' will be invited to match the L1 price for the remaining 50% quantity subject to the Class-I local supplier's quoted price falling within the margin of purchase preference, and contract for that quantity shall be awarded to such 'Class-I local supplier' subject to matching the L1 price. In case such lowest eligible 'Class-I local supplier' fails to match the L1 price or accepts less than the offered quantity, the next higher 'Class-I local supplier' within the margin of purchase preference shall be invited to match the L1 price for remaining quantity and so on, and contract shall be awarded accordingly. In case some quantity is still left uncovered by Class-I local suppliers, then such balance quantity shall be ordered to the L1 bidder.

c) For procurement of **goods / works**, which are **not divisible in nature**, and in **procurement of services where the bid is evaluated on price alone**, the 'Class-I local supplier' shall get purchase preference over 'Class-II local supplier' as well as 'Non-local supplier', as per following procedure(applicable for this tender):

(i) Among all qualified bids, the lowest bid will be termed as L1. If L1 is 'Class-I local supplier', the contract will be awarded to L1.

(ii) If L1 is not 'Class-I local supplier', the lowest bidder among the 'Class-I local supplier', will be invited to match the L1 price subject to Class-I local supplier's quoted price falling within the margin of purchase preference, and the contract shall be awarded to such 'Class-I local supplier' subject to matching the L1 price.

(iii) In case such lowest eligible 'Class-I local supplier' fails to match the L1 price, the 'Class-I local supplier' with the next higher bid within the margin of purchase preference shall be invited to match the L1 price and so on and contract shall be awarded accordingly. In case, none of the 'Class-I local supplier' within the margin of purchase preference matches the L1price, the contract may be awarded to the L1 bidder.

(d) "Class-II local supplier" and "Non-local supplier" will not get purchase preference in any procurement, undertaken by procuring entities.

Verification of local content:

(a) The 'Class-I local supplier'/ 'Class-II local supplier' at the time of tender, bidding or solicitation shall be required to indicate percentage of local content and provide self-certification that the item offered meets the local content requirement for 'Class- I local supplier'/ 'Class-II local supplier', as the case may be. They shall also give details of the location(s) at which the local value addition is made.

(b) In cases of procurement for a value in excess of INR 10.00 Crores, the 'Class-I local supplier'/ 'Class-II local supplier' shall be required to provide a certificate from the statutory auditor or cost auditor of the company (in the case of companies) or from a practicing cost accountant or practicing chartered accountant (in respect of suppliers other than companies) giving the percentage of local content.

(c) Decision on complaints relating to implementation of this order shall be taken by the competent authority which is empowered to look in procurement related complaints relating to the procuring entity.

(d) Nodal Ministries may constitute committees with internal and external experts for independent verification of self declarations and auditors / accountants certificate on random basis and in the case of complaints.

(e) Nodal Ministries and procuring entities may prescribe fees for such complaints.

(f) False **declarations** will be in breach of the **Integrity Pact** for which a bidder or its successors can be debarred for up to two years along with such other actions as may be permissible under law. A supplier who has been debarred by any procuring entity for violation of this Order shall not be eligible for preference under this Order for procurement by any other procuring entity for the duration of the debarment. The debarment for such other procuring entities shall take effect prospectively from the date on which it comes to the notice of other procurement entities.

Reciprocity Clause

(i) When a Nodal Ministry / department identifies that Indian suppliers of an items are not allowed to participate and / or compete in procurement by any foreign government, due to restrictive tender conditions which have direct / indirect effect of barring Indian companies such as registration in the procuring country , execution of project of specific value in the procuring county etc., it shall provide such details to all its procuring entities including CMDs / CEOs of PSEs / PSUs, State Government and other procurement agencies under their administrative control and GeM for appropriate reciprocal action.

(ii) Entities of countries which have been identified by the nodal ministry / department as not allowing Indian companies to participate in their Government procurement for any item related to that Nodal Ministry shall not be allowed to participate in Government procurement in India for all items related to that Nodal Ministry / Department, except for the list of items published by the Ministry / Department permitting their participation.

Note:
NHPC is intending to get exemption from concerned authorities for 'omission of provision of local content requirements for Solar modules and Inverters regarding Public Procurement (Preference to Make in India) for Purchase Preference.' Bidders are advised to quote their bids considering omission of provision of Local content requirements for Solar Modules and Inverters regarding Public Procurement (Preference to Make in India) for Purchase Preference. However, award of works shall be done only after grant of aforesaid exemption.

36. Planning and Designing in purview of Vulnerability Atlas of India

Vulnerability Atlas of India is a comprehensive document which provides existing hazard scenario for the entire country and presents the digitized State/ UT-wise hazard, maps with respect to earthquakes, winds and floods for district wise identification of vulnerable areas. It also includes additional digitized maps for thunderstorms, cyclones and

landslides. The main purpose of this atlas is its use for disaster preparedness and mitigation at policy planning and project formulation stage.

This atlas is one of its kind single point source for various stake holders including policy makers, administrators, municipal commissioners, urban managers, engineers, architects, planners, public etc. to ascertain proneness of any city/location/site to multi-hazard which includes earthquakes, winds, floods, thunderstorms, cyclones and landslides. While project formulation, approvals and implementation of various housing, building and infrastructure schemes, this atlas provides for necessary information for risk analysis and hazard assessment.

The Vulnerability Atlas of India has been prepared by Building Materials and Technology Promotion Council under Ministry of Housing and Urban Affairs, Government of India and available at their website www.bmtpc.org.

It is mandatory for the bidders to refer Vulnerability Atlas of India for multi-hazard risk assessment and include the relevant hazard proneness specific to project location while planning and designing the project in terms of

i) Seismic Zone (II to V) for earthquakes)
ii) Wind Velocity (Basic Wind Velocity 55, 50, 47, 44, 39 & 33 m/s)
iii) Area liable to floods and Probable max. Surge height
iv) Thunderstorms history
v) Number of cyclonic storms/ severe cyclonic storms and max sustained wind specific to coastal region.
vi) Landslides incidences and Annual rainfall normal
vii) District wise Probable Max. Precipitation.

37. **Cyber Security for Power System Equipments**

Ministry of Power (Government of India) has issued Circular no. No.25-l l/6/2018-PG Dated 02.07.2020 on the vulnerabilities in the Power Supply System & Network mainly arise out of the possibilities of cyber attacks through malware / Trojans etc. embedded in imported equipment & Circular No. 12/34/2020-T&R dated 08.06.2021 on Testing power system equipment for use in the Supply System and Network in the country for Cyber Security. Bidders are advised in their own interest to follow these guidelines and circular issued by the Ministry from time to time.

.In order to protect the security, integrity and reliability of the strategically important and critical power supply system & network from cyber-attacks through malware / trozens etc. embedded in imported equipments:

a. All equipments, components, and parts imported for use in Power Supply System and Network shall be tested in the country to check for any kind of embedded malware / Trojans / cyber threat and for adherence to Indian standards.
b. All such testing shall be done in certified laboratories that will be designated by the Ministry of Power (MOP).
c. Any import of equipment / components / parts from “prior reference” countries, as specified or by persons owned by, controlled by, or subject to the jurisdiction or the direction of these prior reference countries will require prior permission of the Government of India.

d. Where the equipment / components / parts are imported from prior reference countries with special permission, the protocol for testing in certified and designated laboratories shall be approved by the Ministry of Power (MOP).

Any cost implication on account of above shall be borne by the contractor. Bidder shall submit the Self-Certificate for Cyber Security as per Attachment-13.

FOUR KEY INSTRUCTIONS FOR BIDDERS

Note The following 'FOUR KEY INSTRUCTIONS for BIDDERS' must be assiduously adhered to:-

i) Obtain individual Digital Signature Certificate (DSC or DC) well in advance of tender submission deadline.

ii) Register your organization on CPPP well in advance of tender submission deadline.

iii) Get your organization's concerned executives trained on CPPP well in advance of tender deadline.

iv) Submit your bids well in advance of tender submission deadline on portal (There could be last minute problems due to internet timeout, breakdown, etc.) While the first three instructions mentioned above are especially relevant to first-time users of portal, the fourth instruction is relevant at all times.

Note: Electronic procurement system will not allow any Bidder to place their bids after the expiry of scheduled date & time. NHPC/ NIC-CPPP shall not be responsible for any delays/ problems related to bandwidth, connectivity etc., which are beyond the control of the NHPC/NIC-CPPPP.

Annexure – 1

FORM OF DECLARATION

I/WE M/s---------- (name of Bidder) having its registered office at ---------- (hereinafter referred to as the Bidder) having carefully studied all the Bidding Documents, pertaining to the Work for "---------- (name of the Work)", and having undertaken to execute the said works.

DO HEREBY DECLARE THAT:

1. We have investigated the site and satisfied ourselves regarding the character of the work and local conditions that may affect the work or its performance and confirm that the work can be performed and completed as required in the contract. Further, we accept all risks directly or indirectly connected with the performance of the Contract.
2. We are familiar with all the requirements of the Contract.
3. We have not been influenced by any statement or promise of any person of the Employer but only the Contract Documents.
4. We are financially solvent.
5. We are experienced and competent to perform the Contract to the satisfaction of Employer.
6. We are familiar with all general and special laws, acts, ordinances, rules and regulations of the Municipalities, District, State and Central Government of India that may affect the work, its performance or personnel employed therein.
7. We have not been banned / de-listed / black listed / debarred from business on the grounds mentioned in para 6 of Guidelines on Banning of Business dealings (Annex-2) to Integrity Pact.
8. We hereby authorize the Employer to seek reference from the bankers of us for its financial position.
9. We undertake to abide by all labour welfare legislations.
10. It is hereby certified that proceedings for insolvency under the Insolvency and Bankruptcy code 2016, or as amended from time to time, have not started against us.
11. The statement submitted by us is true and correct.

For and on behalf of the Bidder

Dated:

Annexure- 2

(To be executed on plain paper at the time of submission of bid/ and on Non-judicial stamp paper of appropriate value by successful Bidder (Contractor) prior to signing of Contract Agreement)

(Format of Integrity Pact)

PRE CONTRACTINTEGRITY PACT

Between

NHPC Limited, a company incorporated under the Companies Act 1956 and having its registered office at NHPC Office Complex, Sector-33, Faridabad-121003 (Haryana), hereinafter referred to as " The Employer" which expression shall mean and include, unless the context otherwise requires, his successors in office and assigns of the **First Part.**

And

M/s _____ , a company/ firm/ individual (status of the company) and having its registered office at represented by Shri _____ , hereinafter referred to as "The Bidder/Contractor" which expression shall mean and include, unless the context otherwise requires, his successors and permitted assigns of the **Second Part.**

WHEREAS the Employer proposes to procure under laid down organizational procedures, contract/s for ----------(Name of the work/ goods/ services) and the Bidder/Contractor is willing to offer against NIT No. .....

WHEREAS the Bidder/Contractor is a private company / public company/Government undertaking/partnership/consortium/joint venture constituted in accordance with the relevant law in the matter and the Employer is a Public Sector Enterprise.

NOW, THEREFORE,

To avoid all forms of corruption by following a system that is fair, transparent and free from any influence/prejudiced dealings prior to, during and subsequent to the currency of the contract to be entered into with a view to:-

Enabling the Employer to obtain the desired said (work/ goods/ services) at a competitive price in conformity with the defined specifications by avoiding the high cost and the distortionary impact of corruption on public procurement, and

Enabling the Bidder(s)/Contractor(s) to abstain from bribing or indulging in any corrupt practice in order to secure the contract by providing assurance to them that their competitors will also abstain from bribing and other corrupt practices and the Employer will commit to prevent corruption, in any form, by its officials by following transparent procedures.

1.0 Commitments of the Employer

1.1 The Employer undertakes that no official of the Employer, connected directly or indirectly with the contract, will demand, take a promise for or accept, directly or through intermediaries, any bribe, consideration, gift, reward, favour or any material or immaterial benefit or any other advantage from the Bidder/Contractor, either for themselves or for any person, organization or third party related to the contract in exchange for an advantage in the bidding process, bid evaluation, contracting or implementation process related to the contact.

1.2. The Employer will, during the pre-contract stage, treat all the Bidders/Contractors alike, and will provide to all the Bidders/Contractors the same information and will not provide any such

information to any particular Bidder/Contractor which could afford an advantage to that particular Bidder/Contractor in comparison to other Bidders/Contractors.

1.3. All the officials of the Employer will report to the appropriate Authority any attempted or completed breaches of the above commitments as well as any substantial suspicion of such a breach.

2.0 In case any such preceding misconduct on the part of such official(s) is reported by the Bidder to the Employer with full and verifiable facts and the same is prima facie found to be correct by the Employer, necessary disciplinary proceedings, or any other action as deemed fit, including criminal proceedings may be initiated by the Employer or Independent External Monitor and such a person shall be debarred from further dealings related to the contract process. In such a case while an enquiry is being conducted by the Employer the proceedings under the contract would not be stalled.

3.0 Commitments of the Bidder(s)/Contractor(s)

The Bidder(s)/Contractor(s) commits themselves to take all measures necessary to prevent corrupt practices, unfair means and illegal activities during any stage of its bid or during any pre-contract or post-contract stage in order to secure the contract or in furtherance to secure it and in particular commit themselves to observe the following principles during participation in the tender process and during contract execution:-

3.1. The Bidder(s)/Contractor(s) will not offer, directly or through intermediaries, any bribe, gift, consideration, reward, favour, any material or immaterial benefit or other advantage, commission, fees, brokerage or inducement to any official of the Employer, connected directly or indirectly with the bidding process, or to any person, organization or third party related to the contract in exchange for any advantage in the bidding, evaluation, contracting and implementation of the contract.

3.2 The Bidder/Contractor further undertakes that it has not given, offered or promised to give, directly or indirectly any bribe, gift consideration, reward, favour, any material or immaterial benefit or other advantage, commission, fees, brokerage or inducement to any official of the Employer or otherwise in procuring the Contract or forbearing to do or having done any act in relation to the obtaining or execution of the contract or any other contract with Employer for showing or forbearing to show favour or disfavour to any person in relation to the contract or any other contract with Employer.

3.3 The Bidder(s)/Contractor(s) shall disclose the name and address of agents and representatives and Indian Bidder(s)/Contractor(s) shall disclose their foreign principals or associates.

3.4 The Bidder(s)/Contractor(s) shall, when presenting their bid, disclose any /all payments made, is commited to or intends to make to agents, brokers or any other intermediaries, in connection with this bid/award of the contract

3.5 Deleted.

3.6 The Bidder, either while presenting their bid or during pre-contract negotiations or before signing the contract, shall disclose any payments made, is committed to or intends to make to officials of the Employer or their family members, agents, brokers or any other intermediaries in connection with the contract and the details of services agreed upon for such payments.

3.7 The Bidder/Contractor will not collude with other parties interested in the contract to impair the transparency, fairness and progress of the bidding process, bid evaluation, contracting and implementation of the contract.

3.8 The Bidder/Contractor will not accept any advantage in exchange for any corrupt practice, unfair means and illegal activities.

3.9 The Bidder/Contractor shall not use improperly, for purposes of competition or personal gain, or pass on to others, any information provided by the Employer as part of the business relationship, regarding plans, technical proposals and business details, including information contained in electronic data carrier. The Bidder/Contractor also undertakes to exercise due and adequate care lest any such information is divulged.

3.10 The Bidder(s)/Contractor(s) commits to refrain from giving any complaint directly or through any other manner without supporting it with full and verifiable facts.

3.11 The Bidder(s)/Contractor(s) shall not instigate or cause to instigate any third person to commit any of the actions mentioned above.

3.12 If the Bidder/Contractor or any employee of the Bidder/Contractor or any person acting on behalf of the Bidder/Contractor, either directly or indirectly, is a relative of any of the officers of the Employer, or alternatively, if any relative of an officer of the Employer has financial interest/stake in the Bidder(s)/Contractor(s) firm(excluding Public Ltd. Company listed on Stock Exchange), the same shall be disclosed by the Bidder/Contractor at the time of filling of tender.

The term 'relative' for this purpose would be as defined in Section 2(77) of the Companies Act 2013.

3.13 The Bidder(s)/Contractor(s) shall not lend to or borrow any money from or enter into any monetary dealings or transactions, directly or indirectly, with any employee of the Employer.

3.14 The representative of the Bidders/Contractors signing Integrity Pact shall not approach the Courts while representing the matters to IEMs and he/she will wait their decision in the matter.

3.15 In case of Sub-Contracting, the bidder shall take the responsibility of the adoption of Integrity Pact by the Sub-Contractor.

4.0 Previous Transgression

4.1 The Bidder(s)/Contractor(s) declares that no previous transgression occurred in the last three years immediately before signing of this Integrity Pact, with any other company in any country in respect on any corrupt practices envisaged hereunder or with any Public Sector Enterprise in India or any Government Department in India.

5.0 Earnest Money (Security Deposit)

The provision regarding Earnest Money/Security Deposit as detailed in the Notice Inviting Tender (NIT) and Instruction to Bidders (ITB) section of the Bid Document is to be referred.

6.0 Sanctions for Violations

6.1 Any breach of the aforesaid provisions, before award or during execution by the Bidder/Contractor or any one employed by it or acting on its behalf such as to put their reliability or credibility in question shall entitle the Employer to take action as per the procedure mentioned in the "**Guidelines on Banning of Business Dealings**" attached as **Annexure-2A** and initiate all or any one of the following actions, wherever required:-

(i) To immediately call off the pre contract negotiations without assigning any reason or giving any compensation to the Bidder/Contractor. However, the proceedings with the other Bidder(s)/Contractor(s) would continue.

(ii) The Earnest Money Deposit (in pre-contract stage) and/or Security Deposit/Performance Bond (after the contract is Signed) shall stand forfeited either fully or partially, as decided by the Employer and the Employer shall not be required to assign any reason thereof.

(iii) To immediately cancel the contract, if already signed, without giving any compensation to the Contractor. The Bidder/Contractor shall be liable to pay compensation for any loss or damage to the Employer resulting from such cancellation/rescission and the Employer shall be entitled to deduct the amount so payable from the money(s) due to the Bidder/Contractor.

(iv) Deleted.

(v) To encash the Bank guarantee, in order to recover the dues if any by the Employer, along with interest as per the provision of contract.

(vi) Deleted .

(vii) To debar the Bidder/Contractor from participating in future bidding processes of NHPC Ltd., as per provisions of "Guidelines on Banning of Business Dealings" of NHPC Ltd. (**Annexure-2A**), which may be further extended at the discretion of the Employer.

(viii) To recover all sums paid in violation of this Pact by Bidder(s)/Contractor(s) to any middleman or agent or broker with a view to securing the contract.

(ix) In cases where irrevocable Letters of Credit have been received in respect of any contract signed by the Employer with the Bidder/ Contractor, the same shall not be opened/operated.

(x) Forfeiture of Performance Security in case of a decision by the Employer to forfeit the same without assigning any reason for imposing sanction for violation of this Pact.

6.2 The Employer will be entitled to take all or any of the actions mentioned at para 6.1 (i) to (x) of this Pact also on the Commission by the Bidder/Contractor or any one employed by it or acting on its behalf (whether with or without the knowledge of the Bidder/Contractor), of an offence as defined in Chapter IX of the Indian Penal Code, 1860 or Prevention of Corruption Act, 1988 or any other statute enacted for prevention of corruption.

6.3 The decision of the Employer to the effect that a breach of the provisions of this Pact has been committed by the Bidder/Contractor shall be final and conclusive on the Bidder/Contractor. However, the Bidder/Contractor can approach the Independent External Monitor(s) appointed for the purposes of this Pact.

7.0 Independent External Monitor(s)

7.1 The Employer has appointed Independent External Monitors (hereinafter referred to as monitors) for this Pact after approval by the Central Vigilance Commission.

7.2 The task of the Monitors shall be to review independently and objectively, whether and to what extent the parties comply with the obligations under this Pact.

7.3 The Monitors shall not be subject to instructions by the representatives of the parties and perform their functions neutrally and independently. The Monitors report to CMD, NHPC.

7.4 Both the parties accept that the Monitors have the right to access all the Contract documents relating to the project/procurement, including minutes of meetings, whenever required. The right to access records should only be limited to the extent absolutely necessary to investigate the issue related to the subject tender/contract.

7.5 As soon as the Monitor notices, or has reason to believe, a violation of this Pact, he / she will so inform CMD, NHPC and request NHPC Ltd. to discontinue or take corrective action, or to

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

7.6 The Bidder(s)/Contractor(s) accepts that the Monitor has the right to access without restriction, to all Project documentation of the Employer including that provided by the Bidder/Contractor. The Bidder/Contractor will also grant the Monitor, upon his / her request and demonstration of a valid interest, unrestricted and unconditional access to their project documentation. The same is applicable to Subcontractor(s). The Monitor shall be under contractual obligation to treat the information and documents of the Bidder/Contractor/Subcontractor(s) with confidentiality. The Monitor has also signed declaration on 'Non-Disclosure Agreement' and of 'Absence of Conflict of Interest'. In case of any conflict of interest arising at an later date, the IEM shall inform CMD, NHPC and recuse himself / herself from that case.

7.7 The Employer will provide to the Monitor sufficient information about all meetings among the parties related to the project provided such meetings could have an impact on the contractual relations between the parties. The parties will offer to the Monitor the option to participate in such meetings as and when required.

7.8 The Monitor will submit a written report to the CMD, NHPC Ltd., within 8 to 10 weeks from the date of reference or intimation to him by the Employer/Bidder and should the occasion arise, submit proposals for correcting problematic situations.

7.9 The word 'Monitor' would include both singular and plural.

8.0 Facilitation of Investigation

In case of any allegation of violation of any provisions of this Pact or payment of commission, the Employer or its agencies shall be entitled to examine all the documents including the Books of Accounts of the Bidder/Contractor and the Bidder/Contractor shall provide necessary information and documents in English and shall extend all possible help for the purpose of such examination.

9.0 Law and Place of Jurisdiction

This Pact is subject to Indian Law. The place of performance and jurisdiction is the Registered Office of the Employer, i.e. Faridabad (Haryana). The arbitration clause provided in the tender document/contract shall not be applicable for any issue/dispute arising under Integrity Pact.

10.0 Other Legal Actions

10.1 The actions stipulated in this Integrity Pact are without prejudice to any other legal action that may follow in accordance with the provisions of the extant law in force relating to any civil or criminal proceedings.

10.2 Changes and supplements as well as termination notice need to be made in writing.

10.3 If the Contractor is a partnership or a consortium or a joint venture, this pact must be signed by all partners of the consortium/joint venture.

11.0 Validity

11.1 The validity of this Integrity Pact shall be from date of its signing and expires for the Contractor 12 months after the last payment under the contract, and for all other Bidders 6 months after the contract has been awarded. Any violation of the same would entail disqualification of the bidders and exclusion from business dealings.

11.2 Should one or several provisions of this Pact turn out to be invalid, the remainder of this Pact shall remain valid. In this case, the parties will strive to come to an agreement to their original intention.

11.3 Issues like Warranty / Guarantee etc. shall be outside the purview of IEMs.

11.4 In the event of any contradiction between Integrity Pact and its Annexure, the clause in the Integrity Pact will prevail.

For & On behalf of the Employer	For & On behalf of the Bidder / Contractor
सनत कुमार / SANAT KUMAR महाप्रबंधक (सिविल) / General Manager (Civil) संविदा–सिविल विभाग / Contracts-Civil Divn. एन एच पी सी लिमिटेड / NHPC Limited (भारत सरकार का उद्यम / A Govt. of India Enterprise) सैक्टर–33, फरीदाबाद / Sector-33, Faridabad (Office Seal) Place---------- Faridabad Date----------	(Office Seal) Place---------- Date----------
Witness1. _____ (Name and address) NHPC 2. _____ (Name and address) SUJA ANANDAN NHPC Ltd.	Witness1. _____ (Name and address) 2. _____ (Name and address)

Annexure-2A

Guidelines on Banning Business Dealings

1. Introduction

NHPC Limited (NHPC) deals with Agencies viz. parties/ contractors/ suppliers/ bidders, who are expected to adopt ethics of highest standards and a very high degree of integrity, commitments and sincerity towards the work undertaken. It is not in the interest of NHPC to deal with Agencies who commit deception, fraud or other misconduct in the tendering process and/or during execution of work undertaken. NHPC is committed for timely completion of the Projects within the awarded value without compromising on quality.

1.2 Since banning of business dealings involves civil consequences for an Agency concerned, it is incumbent that adequate opportunity of hearing is provided and the explanation, if tendered, is considered before passing any order in this regard keeping in view the facts and circumstances of the case.

2.0 Scope

2. 1 NHPC reserves its rights to remove from list of approved suppliers / contractors (if such list exists) or to Suspend/Ban Business Dealings if any Agency has been found to be non / poor performing or have committed misconduct or fraud or anything unethical or any of its action(s) which falls into any such grounds as laid down in this policy.

2.2 The procedure of (i) Removal of Agency from the List of approved suppliers / contractors; (ii) Suspension and (iii) Banning of Business Dealing with Agencies, has been laid down in these guidelines.

2.3 These guidelines shall apply to all the units of NHPC.

2.4 These guidelines shall not be applicable in Joint Venture, Subsidiary Companies of NHPC unless they are assignees, successors or executor.

2.5 The suspension/banning except suspension/banning under Integrity Pact shall be with prospective effect, i.e. future business dealings.

3.0 Definitions

In these Guidelines, unless the context otherwise requires:

i) ***"Agency /Party / Contractor / Supplier / Bidders/Vendors"*** *shall mean and include a public limited company or a private limited company, a joint Venture, Consortium, HUF, a firm whether registered or not, an individual, cooperative society or an association or a group of persons engaged in any commerce, trade, industry, etc. "Party / Contractor/ Supplier / Bidder/Vendor" in the context of these guidelines is indicated as 'Agency'.*

ii) ***"Unit"*** *shall mean the Corporate Office, Project/ Power Station/ Regional Office/ Liaison Office or any other office of NHPC.*

iii) ***"Competent Authority"*** *and* ***'Appellate Authority'*** *shall mean the following:*

a) For works awarded/under Tendering from corporate office (falling in the competency of CMD /Board of Directors).

- Competent Authority: CMD
- Appellate Authority : Board of Directors

b) For works awarded/under Tendering from Corporate Office/Projects/ Power Stations/ Regional Offices/Liaison Offices (falling in the competency of Director /Executive Director)

- Competent Authority: Concerned Director/Executive Director as the case may be
- Appellate Authority: CMD /Concerned Director as the case may be

c) For works awarded/under tendering from Corporate Office / Regional Offices / Projects/ Power Stations/ Liaison Offices (falling in the competency of CGM and below).

- Competent Authority in case of works awarded/under tendering from Corporate Office/Regional office shall be CGM or GM of the concerned division as the case may be.
- Competent Authority: Head of the Unit not below the rank of General Manager
- Appellate Authority: Next higher authority

iv) **"Investigating Committee"** shall mean a Committee appointed by Competent Authority to conduct investigation.

4.0 Initiation of Suspension /Banning

Action for Suspension / Banning Business Dealings with any Agency shall be initiated by the department responsible for invitation of Bids/Engineer-in-charge after noticing the irregularities or misconduct on the part of Agency concerned. Besides the concerned department, Vigilance Department of each Unit/ Corporate Vigilance may also be competent to initiate such action.

5.0 Suspension of Business Dealings.

5.1 If the conduct of any Agency dealing with NHPC is under investigation, the Competent Authority may consider whether the allegations (under investigation) are of a serious nature and whether pending investigation, it would be advisable to continue business dealing with the Agency. If the Competent Authority, decides that it would not be in the interest to continue business dealings pending investigation, it may suspend business dealings with the Agency. The order of suspension would operate for a period not more than six months and may be communicated to the Agency as also to the Investigating Committee. The Investigating Committee may ensure that their investigation is completed and whole process of final order is over within such period. However if the investigations are not completed within six months ,the investigation committee shall put up the proposal to the competent authority for approval of extension of time maximum up to further three months with in which the committee shall conclude the proceedings .

5.2 The order of suspension shall be effective throughout NHPC in case of work falling in the Competency of CMD/ Board of Directors/Directors, in case of work falling in the competency of Executive Director suspension shall be effective throughout

Region /Corporate office (in case the works awarded/under Tendering from Corporate office) .In case of work falling in the competency of HOP or below suspension shall be effective throughout the Project/Power Station and attached liaison offices/units and in case of work falling under the competency of CGM and below at Corporate office suspension shall be effective at Corporate office. During the period of suspension, no business dealing shall be held with the Agency.

5.3 If the Agency concerned asks for detailed reasons of suspension, the Agency may be informed that its conduct is under investigation. It is not necessary to enter into correspondence or argument with the Agency at this stage.

5.4 It is not necessary to give any show-cause notice or personal hearing to the Agency before issuing the order of suspension.

5.5 The format for intimation of suspension of business dealing is placed at **Annexure-2B.**

6.0 Ground on which Banning of Business Dealings can be initiated

6.1 If the security consideration, including questions of loyalty of the Agency to NHPC so warrants;

6.2 If the director /owner of the Agency, proprietor or partner of the firm, is convicted by a Court of Law for offences involving moral turpitude in relation to its business dealings with the Government or any other public sector enterprises, during the last five years;

6.3 If the Agency has resorted to Corrupt, Fraudulent, Collusive, Coercive practices including misrepresentation of facts and violation of the any provisions of the Integrity Pact provided in the Contract.

6.4 If the Agency uses intimidation / threatening or brings undue outside pressure on NHPC or its official for acceptance / performances of the job under the contract;

6.5 If the Agency misuses the premises or facilities of NHPC, forcefully occupies or damages the NHPC's properties including land, water resources, forests / trees or tampers with documents/records etc.

6.6 If the Agency does not fulfil the obligations as required under the Contract and Violates terms & conditions of the contract which has serious affect for continuation of the Contract.

6.7 If the work awarded to the agency has been terminated by NHPC due to poor performance of the contract in the preceding 5 years.

6.8 If the Central Vigilance Commission, Central Bureau of Investigation or any other Central Government investigation Agency recommends such a course in respect of a case under investigation or improper conduct on agency's part in matters relating to the Company (NHPC) or even otherwise;

6.9 On any other ground upon which business dealings with the Agency is not in the public interest.

6.10 If business dealings with the Agency have been banned by the Ministry of Power, Government of India OR any PSU/ any other authority under the MOP if intimated to NHPC or available on MOP Website, the business dealing with such agencies shall be banned with immediate effect for future business dealing except banning under Integrity Pact without any further investigation.

(Note: The examples given above are only illustrative and not exhaustive. The Competent Authority may decide to ban business dealing for any good and sufficient reason).

7.0 Procedure for Banning of Business Dealings

7. 1 An Investigating Committee shall be constituted by the authority competent to Ban the dealing comprising members from Engineering/Indenting department (convener), Finance, Law and Contract. The level of the committee members shall be CGM and above for works falling in the competency of CMD/Board of Directors, General Manager and above for the works falling in the competency of Director/ Executive Director and DGM/SM with at least one member of the level of General Manager for works falling in the competency of CGM and below.

7.2 The order of Banning of Business Dealings shall be effective throughout the NHPC. During the period of Banning of Business Dealings, no Business Dealing shall be held with the Agency.

7.3 The functions of Investigating Committee in each Unit to be appointed by the competent authority in line with para 3 (iii) shall, inter-alia include:

a) To study the report of the department responsible for invitation of bids and decide if a prima-facie case for banning exists, if not, send back the case to the Competent Authority.

b) To recommend for issue of show-cause notice (after vetting by legal deptt.) to the Agency by the concerned department as per clause 7.4 "Show Cause Notice".

c) To examine the reply to show-cause notice and call the Agency for personal hearing, if required.

d) To submit final recommendations to the Competent Authority for banning or otherwise including the period for which the ban would be operative considering the implications for NHPC on account of the act/omission on the part of the agency, intention of the agency as established from the circumstances of the case etc.

7.4 Show Cause Notice

Once the proposal for issuance of Show Cause Notice is approved by the Competent Authority, a 'Show Cause Notice' (as per format at **Annexure -2C** of these guidelines) shall be issued to the delinquent Agency by the Competent Authority or by a person authorized by the Competent Authority for the said purpose. The Agency shall be asked to submit the reply to the Show Cause Notice within 15 days of its issuance. Further, the Agency shall be given an opportunity for Oral hearing to present its case in person, if it so desires, and the date for Oral Hearing shall necessarily be indicated in the Show Cause Notice.

The purpose of issuing the Show Cause Notice is only that the Agency concerned shall be given an opportunity to explain their stand before any action is taken. The grounds on which action is proposed to be taken shall be disclosed to the Agency inviting representation and after considering that representation, orders may be passed. Such orders require only the satisfaction of the authority that passed the final orders.

If the Agency requests for inspection of any relevant document in possession of NHPC, necessary facility for inspection of documents may be provided.

During the conductance of oral hearing, only the regular duly authorized employees of Agency will be permitted to represent the Agency and no outsider shall be allowed to represent the Agency on its behalf.

Reply to the Show Cause Notice given by the Agency and their submissions in oral hearing, if any, will be processed by the Committee for obtaining final decision of the Competent Authority in the matter.

7.5 In case, no reply to Show Cause Notice is received from the Agency within stipulated time, further reminder shall be given with further period of 10 days thereafter if no reply is received action for processing ex-parte against the concerned Agency shall be initiated.

Speaking Order

The speaking order (reasoned order) for banning the business dealing with the Agency shall be issued by the Competent Authority or by a person authorized for the said purpose.

The decision regarding banning of business dealings taken after the issue of a Show Cause Notice and consideration of representation, if any, in reply thereto, shall be communicated to the Agency concerned along with a reasoned order. The fact that the representation has been considered shall invariably be mentioned in the communication. Also the fact that if no reply was received to the Show Cause Notice shall invariably be indicated in the final communication to the Agency. The format for intimation of banning of business dealing is placed at **Annexure-2D.**

7.6 Period of banning

In case banning is processed for violation of provisions of Integrity pact or due to corrupt or fraudulent practices, the Competent Authority shall decide on the period of banning on case to case basis depending on the gravity of the case and considering the implications for NHPC on account of the act/omission on the part of the Agency, intention of the Agency as established from the circumstances of the case etc. The period of banning shall not be less than 6 months and shall not exceed 2 years and in case termination of contract due to poor performance the period of banning shall be for 5 years. For contracts awarded to JV/Consortium, a constituent of the JV shall be permitted to participate in the bidding process if it has not been banned on grounds of its role and responsibility in the tendering process for which the Joint Venture has been banned in Past. In case if the Joint Venture which has been banned does not indicate the roles and responsibility of individual Partner(s) then, the partner of the banned Joint Venture shall only be allowed to participate in the bidding process if its participation share is less than 35%.

In case the information/documents submitted by Agency in competing for the tender found to be false/forged then NHPC, without prejudice to any other rights or remedies it may possess, shall recover from Agency the cost incurred in carrying out physical assessment for establishing veracity of such information/documents. In case Agency refuses to reimburse such cost to NHPC then banning period of Agency shall be extended by another one year.

7.7 Effect of Banning

As far as possible, the existing ongoing contract(s) with the Agency may continue unless the Competent Authority, having regard to the circumstances of the case, decides otherwise, keeping in view contractual and legal issues which may arise thereof. In case the existing Contracts are allowed to continue, the suspension/Banning of Business Dealing along with default of the Contractor shall be recorded in the experience certificate issued for the work.

The Agency, (after issue of the order of banning of business dealings) would not be allowed to participate in any future tender enquiry and if the Agency has already participated in tender process as stand-alone OR constituent of joint venture and the price bids are not opened, his techno-commercial bid will be rejected and price bid will be returned unopened. However, where the price bids of Agency have been opened prior to order of banning, bids of Agency shall not be rejected and tendering process shall be continued unless Competent Authority having regard to the circumstances of the case decides otherwise keeping in view the Contractual, Legal issues which may arise thereafter. However, in case the suspension /Banning is due to default of an Agency for the provisions under Integrity Pact and the Agency happens to be Lowest Bidder (L1), the tendering process shall be annulled and fresh tenders shall be invited.

During the Suspension/ Banning period, if it is found at any stage that Agency has participated in tender enquiry under a different name then such Agency would immediately be debarred from the tender/contract and its Bid Security/Performance Security would be forfeited. Payment, if any, made shall also be recovered.

After Suspension/ Banning order, the Suspended/ Banned Agency shall not be allowed to participate as Sub-Vendor/Sub-Contractor in the tenders.

Further, if the Suspended/ Banned agency is an approved Sub-Vendor under any Contract for such equipment/component/service, the Main Contractor shall not be permitted to place work order/Purchase order/Contract on the Suspended/ Banned agency as a Sub-Vendor /Sub-Contractor after the date of Suspension/ Banning even though the name of the party has been approved as a Sub-Vendor /Sub-Contractor earlier.

There would be no bar on procuring the spares and awarding Contracts towards Annual Maintenance (AMC)/ O&M/ Repair works on Agencies pertaining to the packages for which they have been banned provided the Equipment has been supplied by such Agency.

Banning of business dealing shall not be applicable to the Subsidiary Company of the Banned agency provided subsidiary company has not participated on the strength of the Banned agency. However, in case of a default by a Sub-Contractor, the banning shall be applicable to the Sub-Contractor as well as the Lead Partner of the concerned JV or the Sole bidder as the case may be.

7.8 Hosting at NHPC website

The concerned unit shall forward the name and details of the Agency (ies) banned along with period and reasons of banning to IT&C Division of Corporate Office for displaying the same on the NHPC website.

8.0 Appeal against the Decision of the Competent Authority.

The Agency may file an appeal against the order of the Competent Authority banning of business dealing before Appellate Authority. Such an appeal shall be preferred within 30 (Thirty) Days from the date of receipt of the order of banning of business dealing. Appellate Authority would consider the appeal if convinced may constitute another committee for further investigation. The investigation Committee constituted by the Appellate Authority shall study the report of the previous investigating committee and reply submitted by the Agency while filing its case for appeal and call the Agency for personal hearing , if requested by the Agency. Based on the recommendation of the committee Appellate Authority shall pass appropriate Speaking (Reasoned) order in line with Sub-Para 7.5 above which shall be communicated to the Agency as well as the Competent Authority (as per format enclosed as **Annexure-2E** with these guidelines).

9.0 Circulation of the names of Agencies with whom Business Dealings have been banned

The name of the concerned banned agency shall also be shared with MOP and other PSU in the sector and all the units of NHPC.

The provisions of this policy supersede and will have overriding effect on all earlier guidelines, procedures & system issued for the similar purpose.

Annexure-2B

(Format for Intimation of Suspension of business dealing)

BY REGD. POST/SPEED POST/COURIER

No..... Date.....

To

M/s .....

Attn.: Shri .....

Sub: Intimation of Suspension of Business Dealings

Dear Sir,

Whereas the work of ..... was awarded to your firm vide letter of award no ...dt..... amounting to Rs. ..... OR In response to NHPC NIT (e-tender / physical tender) no .....dt. you have submitted your bid . (strike out whichever is not applicable)
Whereas the conduct of your firm in respect of the following is under investigation:

Brief of the default

"Whereas the Competent Authority prima facie considered the allegations (under investigation) are of a serious nature and decided pending investigation, it is not in the interest of the corporation to continue business dealing with your firm

This order shall have the following effects:

(i) Further business dealings with your firm is Suspended within Region/Project/Unit/wide NHPC. The order of Suspension is effective with immediate effect and would operate for a period of six months or till the investigation is completed and whole process of final order is over within such period. However, if investigations are not completed in six months' time, the Competent Authority may extend the period of Suspension

(ii) During the period of Suspension, no business dealing shall be held with your firm. No enquiry / bid / tender shall be issued to your firm nor will the bids submitted by your firm be entertained.

(iii) In cases where tenders have already been issued to you and price bids are yet to be opened, the Price Bid submitted by you shall not be opened and BG/EMD, if any, submitted by you shall be returned.

(iv) In cases where tenders have already been issued to you and Price Bids have already been opened, the tendering process shall be continued

(v) In case of ongoing contracts between you & NHPC, (including cases were contract has already been awarded before the issue of Suspension order) you will be required to continue with the execution and perform as per terms of the contract.

(vi) (a) In case the Firm is in Joint Venture the following would also be applicable:

i) **Participation of Agency in Joint Venture**
Tenders in which your firm has been proposed as Joint Venture Partner by any of the bidders and price bids have been opened prior to Suspension of your firm in such

cases the tendering process shall not be annulled on this ground and the Agency shall be permitted to continue as Partner in the Joint Venture for such bidding. However where event of Price Bid opening has not taken place prior to Suspension/Banning of Agency then in such case Agency shall not be permitted to participate as Partner in the Joint Venture.

ii) **Banning of joint Venture:**

As the Joint Venture is Banned, your firm intends to bid as Partner(s) of Joint Venture in bidding process then it shall be permitted to participate in the bidding process if it has not been Banned on grounds of its role and responsibility in the tendering process for which the Joint Venture has been Banned in Past. In case if the Joint Venture which has been Banned does not indicate the roles and responsibility of individual Partner(s) then, the partner of the Banned Joint Venture shall only be allowed to participate in the bidding process if its participation share is less than 35%.

(b) Your firm shall not be allowed to participate as Sub-Vendor/Sub-Contractor in the tenders.

Further if your firm is an approved Sub-vendor under any Contract for such equipment/component/service, the Main Contractor shall not be permitted to place work order/Purchase order/Contract on your agency as a Sub-Vendor/Sub-Contractor after the date of Suspension/ Banning even though the name of the party has been approved as a Sub-Vendor/Sub-Contractor earlier.

(c) There would be no bar on procuring the spares and awarding Contracts towards Annual Maintenance (AMC)/ O&M/ Repair works on Agencies pertaining to the packages for which they have been Banned provided the Equipment has been supplied by such Agency.

(d) Banning of business dealing shall not be applicable to the Subsidiary company of the Banned agency provided subsidiary company has not participated on the strength of the Banned agency.

On expiry of the above period of Suspension/Banning, you may approach...

(Indicate the concerned procurement department), with request for revocation of the order mentioning inter-alia the steps taken by you to avoid recurrence of misconduct which has led to Suspension.

Yours faithfully,

For & On behalf of NHPC.

Note: Strike out whichever is not applicable

Annexure-2C

(Format of Show Cause Notice)

BY REGD. POST/SPEED POST/COURIER

No.....

Date.....

To

M/s .....

.....

Attn.: Shri .....

Sub: Show Cause Notice

Ref :

Dear Sir,

You are hereby required to Show Cause in writing within 15 days from the date hereof why Business Dealing with your firm should not be banned / your firm is placed in the Banning List (as the case may be) and be debarred from entering into any contracts with NHPC for the following reasons:

(Give Reasons)

Your reply (if any) should be supported by documents and documentary evidence which you wish to rely in support of your reply. In case, you desire to present your case in person to NHPC, a personal hearing shall be conducted on .....at ..... hours for which prior intimation be furnished to this office. Should you fail to reply to this Show Cause Notice within the time and manner aforesaid, it will be presumed that you have nothing to say and we shall proceed accordingly.

Your reply, if any, and the documents / documentary evidence given in support shall be taken into consideration prior to arriving at a decision.

Yours faithfully,

For & On behalf of NHPC.

Annexure-2D

(Format for Intimation of Banning of Business Dealing)

BY REGD. POST/SPEED POST/COURIER

No..... Date.....

To

M/s .....

Attn.: Shri .....

Sub: Intimation of Suspension of Business Dealings

Dear Sir,

Whereas the work of ..... was awarded to your firm vide letter of award no ...dtd..... amounting to Rs. ..... OR In response to NHPC NIT (e-tender / physical tender) no .....dt. you have submitted your bid .(strike whichever is not applicable)

Whereas the Competent Authority had prima facie considered the allegations as detailed below are of a serious nature and decided to conduct investigation.

" Brief of the Default may be mentioned"

Whereas show cause notice vide no ... dtd.....was served upon you. (whereas in spite of the opportunity given to you, you failed to submit the reply to the show cause notice within the time period mentioned there upon or further extended period, if any). Whereas you submitted the reply along with documents vide your letter no. _____dt. _____and presented your case in the personal hearing dated ..... (if any) . After considering the allegations made in the show cause notice, your reply to the show cause notice documents/documentary evidence in support thereof and personal hearing dated .....(if any), it has been decided to Ban the Business Dealing with you and you are hereby debarred from entering into contracts with NHPC.

(In order to make the Intimation of Banning of Business Dealing Speaking Order (reasoned order), the issue of a Show Cause Notice and consideration of representation in reply to show cause notice , opportunity of personal hearing, if any, shall be communicated to the Agency concerned along with a reasoned order. The order for Banning should also contain the reasons with detailed justification for conclusion of decision to Ban the Agency. Also the fact that if no reply to the Show Cause Notice was received or request for personal hearing was not made shall invariably be indicated in the communication to the Agency. The above order shall mention the grounds considering violation of any provision of Integrity Pact, any ground mentioned in Guidelines of Banning of Business Dealings, default by the agency under fraudulent practice / or any unethical practice and/or violation of any provision of Tender/Contract Condition having serious implications.)

This order shall have the following effects:

i) Further business dealings with your firm is banned with immediate effect . The order of Banning would operate for a period of .....years/month Competent Authority may extend the period of Banning.

ii) During the period of Banning, no Business Dealing shall be held with your firm. No Enquiry / Bid / Tender shall be issued to your firm nor will the bids submitted by your firm be entertained.

iii) In cases where tenders have already been issued to you and Price Bids are yet to be opened, the Price Bid submitted by you shall not be opened and BG/EMD, if any, submitted by you shall be returned.

iv) In cases where tenders have already been issued to you and price bids have already been opened, the Tendering Process shall be continued.

(v) In case of ongoing contracts between you & NHPC, (including cases where contract has already been awarded before the issue of Banning order) you will be required to continue with the execution and perform as per terms of the contract.

(vi) (a) In case the Firm is in Joint Venture the following would also be applicable:

i) **Participation of Agency in Joint Venture**

Tenders in which your firm has been proposed as Joint Venture Partner by any of the bidders and price bids have been opened prior to Banning of your firm in such cases the tendering process shall not be annulled on this ground and the Agency shall be permitted to continue as Partner in the Joint Venture for such bidding. However where event of price bid opening has not taken place prior to Banning of Agency then in such case Agency shall not be permitted to participate as Partner in the Joint Venture.

ii) **Banning of joint Venture:**

As the Joint Venture is banned, your firm intends to bid as Partner(s) of Joint Venture in bidding process then it shall be permitted to participate in the bidding process if it has not been banned on grounds of its role and responsibility in the tendering process for which the Joint Venture has been banned in Past. In case if the Joint Venture which has been banned does not indicate the roles and responsibility of individual Partner(s) then, the partner of the banned Joint Venture shall only be allowed to participate in the bidding process if its participation share is less than 35%.

(b) Your firm shall not be allowed to participate as Sub-Vendor/Sub-Contractor in the tenders.

Further if your firm is an approved Sub-vendor under any Contract for such equipment/component/service, the Main Contractor shall not be permitted to place work Order/Purchase Order/Contract on your agency as a Sub-Vendor/Sub-Contractor after the date of Banning even though the name of the party has been approved as a Sub-Vendor/Sub-Contractor earlier.

(c) There would be no bar on procuring the spares and awarding Contracts towards Annual Maintenance (AMC)/ O&M/ Repair works on Agencies pertaining to the packages for which they have been banned provided the Equipment has been supplied by such Agency.

(d) Banning of Business Dealing shall not be applicable to the Subsidiary company of the Banned Agency provided subsidiary company has not participated on the strength of the Banned Agency. However, in case of a default by a Sub-Contractor, the banning shall be applicable to the Sub-Contractor as well as the Lead Partner of the concerned JV or the Sole bidder as the case may be.

On expiry of the above period of Banning, you may approach..... (Indicate the concerned procurement department), with request for revocation of the order mentioning inter-alia the steps taken by you to avoid recurrence of misconduct which has led to Banning.

Further if you desire to appeal against this order you may do so within 30 days from the date of issue of this order to the appellate authority as here under:

Appellate Authority: .....

Designation:

Address:.....
Ph . no.
e-mail :

Yours faithfully,

For & On behalf of NHPC.

Note: Strikeout whichever is not applicable

Annexure-2E

(Format for communication of Appellate Decision on Suspension/Banning Order)

BY REGD. POST/SPEED POST/COURIER

No.....

Date.....

To, M/s .....

Attn.: Shri .....

Sub: Suspension Banning of Business Dealings - Intimation of decision of Appellate Authority

Ref: 1. Order dated ..... Placing M/s ..... on Suspension/Banning List by NHPC;

2. Your Appeal reference ..... Dt.....

Dear Sir,

[

This has reference to the order dt..... placing you on Suspension/Banning List and your appeal petition reference ..... dt.... on the same.

After considering the findings of the Original Authority in order and submissions made by you in your appeal , and the documents/documentary evidences available on record, it has been decided finally that :

* There is no infirmity in the order of the Original Authority, and the allegations stand substantiated and the Suspension/Banning for the period of ..... years/month from the date of order, as ordered by the original Authority is upheld,
* Considering your submissions, the order of Suspension/Banning passed by the original authority is upheld , but with a reduction in period of Suspension/Banning for ..... years/months from the date of order of original authority;
* Considering your submissions and the evidence available on record, there is enough justification to annul the order of the original authority.

(*** Incorporate any one of the above as applicable

##In order to make the Communication of Appellate Authority on Banning of Business Dealing Speaking Order (reasoned order), the fact that the representation of the agency has been considered and reference of grounds brought forward by the Agency in his defense and if any opportunity of personal hearing has been given to the Agency as a part of principle of natural justice shall invariably be mentioned in the communication, The order for Banning should also contain the reasons with detailed justification for conclusion of decision to Ban the Agency. Also the fact that if no sufficient ground has been furnished shall invariably be indicated in the final communication to the Agency. In case the option for Banning of Agency or reduction of Time Period for Banning of Agency is exercised then the above order shall mention the grounds considering violation of any provision of Integrity Pact, any ground mentioned in Guidelines of Banning of Business Dealings, default by the agency under fraudulent or any unethical practices and/or violation of any provision of Tender/Contract Condition having serious implications.)

Yours faithfully,

For & On behalf of NHPC

ANNEXURE-3

QUALIFICATION INFORMATION SHEETS

Annexure-3A

General Information

Bidders are requested to complete the information

<table>
<tr><td>1.</td><td>Name of firm</td><td></td></tr>
<tr><td>2.</td><td>Head office address</td><td>Country:</td></tr>
<tr><td>3.</td><td>Telephone
Fax
Email</td><td>Contact Person(s)
Name
Title/Position</td></tr>
<tr><td>4.</td><td>Place of incorporation / registration
Date</td><td></td></tr>
<tr><td>5.</td><td colspan="2">Legal status of firm
Field of speciality in business</td></tr>
<tr><td>6.</td><td>Number of present permanent employees:</td><td><table><tr><td>Detail</td><td>Civil Engineers</td><td>Other Engrs</td><td>Non Engineering</td></tr><tr><td>Nos.</td><td></td><td></td><td></td></tr></table></td></tr>
<tr><td>7.</td><td>Quality assurance system in head office</td><td>Certified by:</td></tr>
<tr><td>8.</td><td>Agent or representative in INDIA
Name
Address
Telephone</td><td>(if exists)

Fax & Email</td></tr>
</table>

Date Signature

Annexure -3B

SUMMARY OF WORK EXPERIENCE

I. SUMMARY OF LIST OF WORKS COMPLETED AS ON DATE OF SUBMISSION OF TENDER

S. No	Description of the Work & contract No.	Contract Awarded by	Contract Value	Date of contract awarded	Date of completion as per agreement	Date of commencement of work	Actual completion Date	Final value of Contract

Note:

i.) Supportive documents / certificates from the Organizations' with whom they worked/ are working should be enclosed.

Signature of Bidder
Seal of the Company

Annexure -3C

DELETED

{Ref. Sub-Article No.2.1(ii) of ITB}

Annexure – 4

FORM OF SELFDECLARATION OF INELIGIBILITY UNDERTAKING

I/ We, M/s ……(Name of Bidder) hereby certify that I/we are not under the declaration of ineligibility for banning/ de-listing/ black listing/ debarment from business on the ground mentioned in Para 6 of Guidelines on banning of Business dealing (Annexure-2) to integrity pact, (ITB Clause 2 of Tender document) at the time of submitting of bid and shall intimate immediately of any such banning/de-listing/black listing/ debarring after submission of bid till the award of Tender.

(Seal & Signature of the Bidder)

Annexure -5A

DELETED

Annexure-5B

Deleted

(III): PROCEDURE FOR E-REVERSE AUCTION (e-RA)

- ANNEXURE -6 : Conditions of conducting e-RA after e-tendering
- ANNEXURE -7: Business Rule for e-RA
- ANNEXURE -8: Process Compliance form for e-RA
- ANNEXURE -9: Price Confirmation form for e-RA

ANNEXURE - 6

1.0 Conditions for conducting e-RA after e-tendering

1.1 E-RA shall be implemented at Application Service Provider's Portal selected by NHPC.

1.2 E-RA shall be followed after e-tender, if number of eligible bidders at price bid stage is at least 2 (two). e-RA shall be carried out on the basis of "**Bid Price per Units of Generation**" calculated by dividing the total (in INR) of **Price Schedule No. 4** and cost of withdrawal of deviations, if any, indicated in Attachment No. 6A by **"Total Generation in Units (kWh)"** quoted by the Bidder in **Price Schedule No. 5** considering the target generation using latest version software as defined in ITB. The value of thus derived "**Bid Price per Units of Generation**" shall be rounded off up to two (2) decimal places in evaluation. The H1 bidder (whose derived "**Bid Price per Units of Generation**" as detailed in this paragraph is highest) will not be allowed to participate in further Reverse Auction process provided minimum three bidders are left after removal of H1 bidder.

1.3 "The bidders shall not be allowed to alter/modify the **"Total Generation in Units"** (as quoted under **Price Schedule No. 5)** during the entire bidding process including e-Reverse Auction."

1.4 The Base Bid Price for e-Reverse Auction shall be the lowest "**Bid Price per Units of Generation**" **as derived in Clause 1.2** as described above. Decrement for e-reverse auction shall be minimum 0.1% and its multiple thereof.

In cases where no bidder accepts to quote lower than the base "**Bid Price per Units of Generation**," e-RA is to be treated as invalid and the Employer proceeds for fresh e-RA or tenders shall be evaluated based on "**Bid Price per Units of Generation**" **as derived in Clause 1.2** in already opened e-Tender. The decision of the Employer in this regard shall be final and binding on the bidders.

1.5 After e-Reverse Auction and evaluating the lowest bid of the bidder based on lowest "**Bid Price per Unit of Generation**", the award shall be processed as per the procedure defined in the bidding document.

1.6 In case of failure of e-RA process for any reasons, e-tender results will be processed for award. Further, NHPC shall reserve the right to call the *L1 bidder for further process/negotiation or to cancel the e-reverse auction process/ re-tender at any time.

* *L1= Successful Bidder after e-Reverse Auction (as the case may be)*

ANNEXURE-7

Business Rules for e-Reverse Auction

1) NHPC have presently made arrangements with Application Service Provider**,** who will be NHPC's authorized Service Provider for e-Reverse Auction (e-RA). Please go through the guidelines given below and submit your acceptance to the same.

2) Bidders who are found technically and commercially acceptable and whose Price Bid is as per the Bid Condition after e-tender are eligible to participate in e-RA. The intimation of schedule date & time to conduct e-RA shall be sent to eligible bidders in advance. E-Reverse Auction (e-RA) shall be conducted by Application Service Provider on scheduled date and time. Eligible bidders shall participate from their own offices / place of their choice. Internet connectivity shall be ensured by the respective bidders themselves. Designated officials i.e. Tender Inviting Authority of NHPC shall have access to portal and shall witness e-RA process.

3) Application Service Provider shall arrange to demonstrate / train (if not trained earlier) bidders' nominated person(s), without any cost. They will also explain all the Rules related to e-Reverse Auction/Business Rules Document to be adopted along with training manual.

   The Application Service Provider (ASP) shall arrange to demonstrate/ train (if not trained earlier) bidders' nominated person(s) through ONLINE training by ppts / Audio Visual file without any cost. These training materials shall remain available on the portal all the time whenever bidders access the portal for such purposes. If bidders require any explanation in regard to the Rules related to e-Reverse Auction / Business Rules Document to be adopted along with bid manual, the same shall be explained to the bidder through any means of communication i.e. telephonic/email.

4) Before start of e-RA process, NHPC will provide the template calculation sheet (Spreadsheet) which will help bidders to arrive at "**Bid Price per units of Generation***"* for the total scope of work. This calculation sheet shall include:

   i. **Schedule- 4:** Grand Summary of Price Schedules 1 to 3 quoted by the bidder in Price Bids**.**
   ii. **Cost of withdrawals of deviations, if any, indicated in Attachment No. 6 A.**
   iii. **Schedule- 5:** Total Generation in Units quoted by the bidder under this schedule, duly certified by NHPC, as applicable.
   iv. **Schedule-6:** Bid Price per units of Generation as obtained by spreadsheet calculations in Price Bids including cost of withdrawal of deviations , if any, indicated in Attachment No. 6 A.

   Rank of the bidders would be displayed as per the *"***Bid Price per units of Generation***"* quoted by the Bidder in **Price Schedule-6 Including cost of withdrawal of deviations, if any, indicated in Attachment No. 6A.**

5) The Start Bid Price (SBP) for e-Reverse Auction shall be Lowest Bidder's derived "Bid Price per unit of Generation" **as** above.

6) **Procedure of e-Reverse Auctioning:**

   Dynamic Template Bidding (Rank Disclosed)

   i. In '*Dynamic Template Bidding (Rank Disclosed)***',** bidders shall enter the "**Bid Price per unit of Generation***"* in line with clause 4 above for the total scope for subject Package. The value of decrement must be in decremented slab of minimum 0.1% and its multiple thereof of "**Lowest Bid Price per units of Generation***"* after e-tender.

   ii. In the "Dynamic Bidding" **tie bid** is not allowed on Lowest "**Bid Price per unit of Generation***"* at e-RA Portal, i.e. if any higher price ranked vendor places bid equal to Lowest "**Bid Price per unit of Generation***"* in e- reverse auction, their bid will be rejected. The bidder is required to click on "Rejected" to know the reason of bid rejection. In that case, the bidder will have to instantly reduce their price within 5 minutes to submit lower quoted "**Bid Price per units of Generation***"* otherwise the "**Bid Price per units of**

Generation" will be considered as higher bid or rejected bid (system does not support tie bids in this type of auction).

iii. The "**Bid Price per unit of Generation**" received under e-RA shall be evaluated on the basis of evaluation method specified in the bidding document and the final evaluated prices thus obtained shall be used for comparison of bids

7) Within one (1) hour after conclusion of e-RA, successful bidder shall furnish confirmation through his registered e-mail id to the Tender Inviting Authority for present tender the following:

I. Final "**Bid Price per unit of Generation**" **(Schedule- 6)** quoted in Reverse Auction and

II. Total Price schedule **(Schedule- 4: Grand Summary**) already available with them and revised in line with final "**Bid Price per unit of Generation" (Schedule- 6)** quoted in Reverse Auction without any new condition other than those already agreed before start of Reverse Auction (**Annexure-6**).

In case, there is any variation between the final "**Bid Price per unit of Generation**" quoted in Reverse Auction and the document received after Auction, the first i.e. "**Bid Price per unit of Generation**" in Auction will be taken as final offered "**Bid Price per units of Generation**" by the bidder.

However, the detailed break-up of final prices as per price format (Price Schedule 1 to 3) shall be submitted by the successful bidder on pro rata basis matching with the "**Bid Price per unit of Generation**" **(Schedule- 6)** determined during e-Reverse Auction and Total Price Schedule **(Schedule- 4: Grand Summary**) revised in line with "**Bid Price per unit of Generation" (Schedule- 6)**quoted in Reverse Auction and **Total Generation in Units (Schedule-5)** within three days from the date of conclusion of e-Reverse Auction.

8) Auction shall be for a period of **60 minutes**. The bidding continues with an auto extension of **10 min** time if any Bidder quotes a further lower price within final 10 minutes of specified closing time of auction.

In final countdown and auto extension time, the Lowest "**Bid Price per unit of Generation**" at e-RA Portal would be visible to all the vendors who have placed valid bids. However, real identity of the bidder would not be disclosed during entire e-reverse auction process. The bidding could continue even after the final run till the time there are no changes in prices within aforesaid final 10 minutes.

9) During Auction, if no bid is received within the specified time, NHPC, at its discretion, may decide to close the reverse auction process and proceed with results of e-tendering.

10) Each Bidder shall be assigned **Unique User Name** & **Password** by Application Service Provider**.** Bidders are advised to change the Password and edit the information in the Registration Page after the receipt of initial Password from Application Service Provider to ensure confidentiality. All bids made from the Login ID given to the bidder will be deemed to have been made by the bidder.

11) Bidders shall be able to view the following on their screens along with the necessary fields during the auction.

a. Rank of the respective bidder[@]

b. Bid placed by the respective bidder.

@ "Bid Price per units of Generation" of* Lowest *bidder at e-RA Portal will be displayed in the last 10 minutes and in auto extension time.

12) Consequent upon completion of e-Reverse Auction, NHPC's decision on award of contract shall be final and binding on all the bidders.

13) NHPC shall be at liberty to call the *L1 bidder for further process/ negotiation/ cancel the e-reverse auction process/ re-tender at any time, without assigning any reason thereof.

14) NHPC/ Service Provider shall not have any liability to bidders for any interruption or delay in access to the site irrespective of the cause.

15) NHPC along with Service Provider can decide to reschedule or cancel any Auction; the bidders shall be informed accordingly.

16) The bidder shall not involve himself or any of his representatives in price manipulation of any kind directly or indirectly by communicating with other bidders. The bidder shall also not divulge either his bid or any other exclusive details of NHPC to any other party. If it has come to notice of NHPC/Service Provider that bidders have colluded while submitting price in e-RA, the same be dealt as per provision of Integrity Pact.

17) Any updation/ modification in the e-RA process brought out above shall be conveyed in advance to the bidders before e-RA.

18) Other terms and conditions shall be as per the bidding documents.

[*] *L1= Lowest Evaluated Bidder after e-Reverse Auction (as the case may be)*

ANNEXURE - 8

Process Compliance Form for e-Reverse Auction

(*Bidders are required to submit this on their Company's Letter Head and sign & stamp)*

To,

____Name, Designation, Address of Tender Inviting Authority___

Contact Person: ……
E-mail: **……**

Sub: Agreement to the Process related Terms and Conditions

Dear Sir,

This has reference to the Terms & Conditions for the e-Reverse Auction mentioned in the Business Rules for <…..*Name of tender Package & Tender Specification No*.: ……..>

This letter is to confirm that:

1. The undersigned is authorized representative* of the Company.
2. We have studied the e-Reverse Auction Terms & Conditions and the Business Rules governing the e-Reverse Auction as mentioned in the bid document and confirm our agreement to them.
3. We also confirm that we shall take the training on the auction tool and shall understand the functionality of the same thoroughly, before start of e-RA.
4. We also confirm that we will submit price confirmation within an hour of conclusion of e-Reverse Auction through company email ID. However, break up of our final offered price in e-Reverse Auction as per NHPC's Price format and as per conditions of e-RAshall be submitted within three (3) working days . We also confirm that we will not increase unit rate of any item submitted in our bids.
5. Our registered email id is _____.

We hereby confirm that we will honor the Bids placed by us during the auction process.

With regards

Signature with company seal

Name –

Company / Organization –

Designation within Company / Organization –

Address of Company / Organization –

**Person having power of attorney for the subject package*

ANNEXURE-9

Format for submitting Price Confirmation for e-Reverse Auction

(To be submitted on Company Letter Head duly signed and stamped)

REF No. …….. Date: ……

To,

____Name, Designation, Address of Tender Inviting Authority___

Contact Person: ……
E-mail: **……**

Re: Price Confirmation for thee-Reverse Auction of ….....

Auction Notice Dated: ……....

For Procurement of... [...Name of package.....].

For M/s NHPC LIMITED E-Tender Id no.....

Reference above, we here by confirm that we have given our final offer in the e-Reverse Auction System as per the template, which is attached herewith duly signed and stamped from our end:

(i) Final quoted Price Schedule 6 *:* Bid Price per units of Generation
(ii) Final Price Schedule 4: Grand Summary (Sum of Price Schedules -1 to 3) in conformity with Final quoted Price Schedule 6.
(iii) Item- wise breakup of Price Schedules – 1 to 3 in conformity with Final Price Schedule- 4 : Grand Summary submitted by us through our registered email id.

Signature:
Name: Designation:
Seal of the Company:

VOLUME 1

INFORMATION FOR BIDDERS

INFORMATION FOR BIDDER

1. PROFILE OF NHPC

NHPC Limited, formerly known as National Hydroelectric Power Corporation Ltd. was established in 1975. NHPC is a Mini Ratna Category-I Enterprise of the Government of India. With an authorized share capital of Rs. 15,000 Crores, NHPC is ranked as a premier organization in the country for development of hydropower. The Company successfully concluded its initial Public Offer (IPO) worth over Rs. 6,000 Crores and become listed company on NSE & BSE with effect from 1st September 2009. So far, NHPC has completed 24 projects with a total installed capacity of 7071.2 MW which includes 1520 MW through NHDC Limited – a joint Venture of NHPC with Government of Madhya Pradesh.

NHPC has been allowed to plan, promote and organize an integrated and efficient development of power in all its respects through conventional and non-conventional sources in India and abroad on its own. The Company is actively exploring opportunities in Pumped Hydro, Green Hydrogen, Battery Energy Storage in addition to Hydro Power and recently formed NHPC Renewable Energy Limited (NHPC REL) for development of renewable energy, small hydro and green hydrogen projects through a focused approach.

NHPC has commissioned a 50 MW Wind Power project at Lakhmana, Jaisalmer, Rajasthan in Sept`2016 and 50MW Solar Power Plant in Tamilnadu in March 2018. NHPC is further in process of development of Renewable Energy Projects in various potential rich states across the country under different Govt. of India Schemes.

2. PROJECT INFORMATION

NHPC won 200 MW capacity in Request for Selection (RfS) of GUVNL for setting up of Solar PV Power Project in 600 MW Solar Park (Stage-1) of Gujarat State Electricity Corporation Ltd. (GSECL) at Khavda, Gujarat. Accordingly, this proposal is for setting up of 200MW Grid connected Solar PV Power Project within the Solar Park of GSECL. NHPC has conveyed their first and second preference for plot no. S13 & S14 and further requested for allotment of same to NHPC for setting up of 200 MW project. The confirmation from GUVNL is awaited.

Indicative Land Area, location and plot no. shall be as per GSECL Solar Park South Block drawings which is attached as **Annex-1**. The same is also available on Google link provided by GUVNL.

This project shall be designed for delivery of quoted energy at 400/765 kV Substation of CTU (KPS-II) at Khavda i.e. at CTU Periphery through 33/400 kV Internal Pooling Sub-station of Solar Park, being developed by GSECL.

Land for the project maximum @1.85 Ha/MW, common infrastructure such as Internal Pooling Substation (33/400kV), associated transmission lines up to 400/765kV Khavda PS-II of CTUIL, metering system, roads, water supply system, drainage system, Street Light, Fire & Weather Station, fencing on the outer periphery of solar park (wherever necessary), security points for entire security of park etc shall be provided by the GSECL.

Internal fencing of plot(s) arrangement is mandatory and is in the scope of Contractor.

Internal storm water main drainage system of the park is in the scope of GSECL. Developers may connect their drain with the same. As per the RfS OF GUVNL, GSECL

is providing storm water drainage system along the periphery of entire plot and developer has to discharge their internal drain into the park drainage.

GSECL will lay and maintain the main roads i.e. at least one approach road so as to provide access to all the plots in the Solar Park. Internal access roads within plot and connectivity road with the plot shall have to be laid by the Contractor at its own cost.

For common facilities to be provided by GSECL in the Solar Park, GSECL is charging one-time Solar Power Park Development Expenses or "Upfront Development Charge (UDC)". For Operation & Maintenance of Solar Park, GSECL will separately recover O&M charges annually for O&M of the facilities. In addition, land lease charges & water consumption charges would be levied separately by GSECL. UDC, Park O&M Charges, land lease charges & water consumption charges shall be paid by NHPC and are not in Bidders Scope.

All Other charges/ cost in respect of 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/ GUVNL RfS including amendments/ clarifications, procedures issued by bodies like CERC/SERC, CEA, RLDC/ NLDC/SLDC, CTU/ STU/ Grid India, MNRE, other Ministry etc shall be deemed to be included in the scope of work of the Successful bidder.

3. BRIEF SCOPE OF WORK

The scope of the proposal shall be Design, Engineering, Supply, Construction, Erection, Testing and Commissioning of 200 MW Solar PV Power Project in 600 MW Solar Power Park of GSECL (Stage-1) at Khavda along with power evacuation system. The scope also includes five (05) years comprehensive Operation and Maintenance (O&M) of the solar PV plant as well as Annual Maintenance Contract (AMC) of critical equipment for a period of ten (10) years. The AMC of contract will be part of O&M Contract.

The scope of work covers the following activities and services in respect of all the equipment & works specified and covered under the technical specifications and at other places in bid document.

All equipment, materials and services whether explicitly stated or otherwise and that are necessary for the satisfactory operation of the Solar PV system and its integration with the existing AC Systems as described in the specification shall be deemed to be included in the scope of work of the Contractor and shall not be limited to the following:

a. Basic Engineering of the plant and systems.
b. Detailed design of all the equipment and equipment system(s) including civil works.
c. Site - Grading & Clearing of Vegetation (if required), Topographical survey (Optional), Geotechnical Investigation (Optional).
d. Providing, Review and approval of engineering drawings, data, process
e. Calculations, test procedures, Structural Design Calculations, Equipment Layout, Drawings / Data sheets of bought out items, Civil Structural / Architectural Drawings, PG Test etc.
f. Providing Operation & Maintenance/ instruction manuals, as built drawings and other information
g. Providing training of Employer's personnel
h. Finalization of sub-vendors, manufacturing quality plans and Field quality plans.
i. Complete manufacturing including conducting all type, routine and acceptance tests; Civil, Structural and Architectural works to the extent applicable, including construction facilities and construction power distribution.

j. Packing and transportation from the manufacturer's works to the site including customs clearance & port clearance, port charges, (if any).
k. Receipt, storage, preservation and conservation of equipment at the site; Fabrication, pre-assembly, (if any), erection, testing, pre-commissioning and commissioning and putting into satisfactory operation all the equipment including successful completion of initial operation.
l. Reliability and Functional guarantee tests after successful commissioning of full capacity
m. Supply of Spares.
n. Satisfactory completion of the contract.
o. Special tools and tackles if any required for maintenance of the plant.
p. Installation and commissioning of SCADA, PPC, Telemetry, OWS at Solar plant MCR with supply and laying of OFC and associated hardware and software.
q. All the works related to interfacing of Solar plant data with Solar Park infrastructure/ LDC / MNRE/GUVNL etc

4. MODE OF PROJECT DEVELOPMENT

The proposed 200 MW Solar PV Power Project shall be executed as Single EPC Package under domestic competitive bidding followed by e-Reverse Auction (e-RA). The successful bidder will be decided on the basis of lowest C/G (quoted cost/ generation). The quoted Annual Generation shall be fixed during entire bidding process including Reverse Auction (RA) for the respective bidder.

5. SITE RELATED TECHNICAL AND GEO-TECHNICAL DETAILS AND OTHER INFORMATION/TECHNICAL REPORTS AND ASSESSMENT

The following Technical and geo-technical details and other information/ technical reports related to Khavda Site may be downloaded from the Google drive link created by GSECL and provided below -

1. Hydrology report GSECL RE Park.
2. Substation Drawing, Single Line Diagram-SOUTH-BLOCK.
3. Power Evacuation System Drawing (Substation Block Diagram).
4. Contour and topography.
5. Survey with respect to Mean Sea Level-South block.
6. Brief Study & Survey
7. Raw water rising main layout.
8. Soil Testing Report
9. Other Document related to coordinate, Khavda infrastructure KMZ File etc

Google drive link:
https://drive.google.com/file/d/1rh1_zfit1biKprii_dFNy_HGgQ1m37F6/view?usp=sharing

The information provided in above documents may be treated as indicative only, bidder needs to verify/ acquaint/apprise himself for the actual details. No Claims and objections due to any information contained in the above report shall be considered.

Before submitting his bid, the bidder should inspect and examine the site and its surroundings and should satisfy himself as to the nature of the ground and subsoil, the quantities and nature of work, materials necessary for completion of the work and their

availability, means of access to site and in general shall himself obtain all necessary information as to risks, contingencies and other circumstances which may influence or affect his offer. No consequent extra claims on any misunderstanding or otherwise shall be allowed by the Employer.

6. DETAILS ABOUT IDENTIFIED DUMPING AREA

Disposal of waste excavated material not reusable in levelling and construction shall be disposed by the contractor in the disposal sites arranged by him after seeking prior permission of the concerned local authorities and in compliance to all applicable laws. Dumping area shall not be made available by the Employer. In no case shall it be disposed in the nearby Rivers and is strictly prohibited.

7. CONSTRUCTION POWER REQUIREMENT AND POWER DRAWAL DURING COMMISSIONING AND CONTRACTUAL O&M PERIOD

Construction power shall be arranged by Contractor on their own. GSECL/ NHPC will extend necessary support in obtaining the power supply connection. Contractor may use any other source of power, subject to approval/consent from competent authority.

Contractor shall bear the charges for import of energy from grid during commissioning and contractual O&M period and shall be required to make payment to GUVNL at the tariff of relevant HT category as determined by GERC from time to time.

8. WATER REQUIREMENT

Water requirement during construction period shall be arranged by Contractor of its own.

Water Supply during O&M period shall be provided by GSECL. As per the details mentioned in RfS of GUVNL, maximum 6 KL/MW/Cycle will be supplied so as to complete three cleaning cycle every month. However, the supply of water shall be dependent upon the availability of water. GSECL will install and commission Desalination plant.

GSECL will provide water at a single source/offtake point through a meter for each plot. Contractor shall collect the water supplied by GSECL in a ground level water tank and water from this tank shall be used by Contractor by making its own arrangements as required. Water charges shall be borne by Contractor during contractual O&M period.

9. CONTRACTOR'S INFRASTRUCTURAL FACILITIES

The contractor has to make his own arrangement to develop infrastructure for all their man and materials required during the construction period. Necessary residential and labour camps including other facilities like water supply, sanitation etc. is to be developed /arranged by the contractor on his own including its maintenance during the construction period & O&M of the Project. All the camps, facility areas, main works area etc. are required to be fenced and protected by the contractor on his own. The manpower engaged by the Contractor for the works of the project shall be mainly from local population to the extent available. However, in case of non-availability of highly skilled/semi-skilled manpower among local population, the same shall be arranged from outside.

For working hours, Labour Colony, work permit from local bodies etc. Contractor to take necessary approval from local police authority / BSF/LMA. GSECL/ NHPC shall provide necessary assistance / documentation to Contractor for the approval of police / BSF/LMA. Restrictions with respect to security to be followed in line with LMA/Local authority guideline.

10. ISSUE OF MATERIALS TO THE CONTRACTOR

All the construction materials required for construction project shall have to be arranged by the Contractor himself. Sufficient storage facilities, if required, shall have to be created by the contractor to ensure the availability of construction material and machinery required during the project execution. Transportation of materials to site shall be responsibility of the Contractor.

11. DETAILS ABOUT LOCAL, STATE AND CENTRAL TAXES LEVIABLE IN THE STATE OF GUJARAT.

The Contractor should verify incidence of Local, State & Central Taxes and other charges and its rates leviable in the State of Gujarat before filling his price Bid.

12. POWER EVACUATION ARRANGEMENT

GSECL will provide all necessary evacuation facilities such as 400/ 33 kV Internal Pooling Substation and its associated transmission lines for interconnection of the Project and evacuation of power from the Project up to interconnection point. The internal pooling sub-stations are connected with 400/765 kV Khavda PS-II (CTUIL) Substation.

Contractor shall have to connect their power project to 33 kV bus of 400/33 kV Internal Pooling Substation by laying 33 kV cables as per norm and requirement of GSECL. 33 kV overhead internal Transmission line is not allowed. 33 kV side of Internal Pooling Substation shall be indoor switchgear. GSECL shall provide Right of Way to install necessary 33 kV cable up to Internal Evacuation Substation.

The Contractor shall be required to follow all the applicable guidelines including the guidelines of the for BSF/LMA and /or Defence and R&B or any other authorities issued time to time.

Length of 400 KV quad moose conductor from GSECL PS to CTUIL PS is approximately 2.5 KM.

South block Pooling Substation SLD and Substation Block Diagram as provided by GUVNL is attached as **Annex-2** for reference. The same is also available on Google link provided by GUVNL.

13. GRID CONNECTIVITY & STATUTORY COMPLIANCES

GSECL has secured connectivity and LTA from CTU for Khavda Solar Park.

The Contractor shall be responsible for terminating their 33kV evacuation feeder at 33kV Main Pooling Switchgear built by GSECL.

Bidder shall comply all provisions and amendments thereafter of

1) Central Electricity Regulatory Commission (Connectivity and General Network Access to the inter-State Transmission System) Regulations, 2022
2) CERC 'Detailed Procedure for Connectivity and GNA' under the Central Electricity Regulatory Commission (Connectivity and General Network Access to the inter-State Transmission System) Regulations, 2022"
3) CEA (Technical Standards for Connectivity to Grid) Regulation,2007
4) CEA (Technical Standards for construction of Electrical Plants and Electrical Lines) Regulation,2022
5) CEA (Grid Standard) Regulation,2010

6) CEA (safety requirements for construction, operation and maintenance of Electrical Plants and Electrical Lines) Regulations,2011
7) CEA (Measures relating to Safety and Electrical Supply) Regulations,2010
8) CEA (Installation and Operation of Meters) Regulations 2006
9) Indian Electricity Grid Code Regulation,2010
10) CEA (Technical standards for communication system in Power system operations) Regulation 2020
11) CERC (Communication System for Inter State Transmission of Electricity) Regulations 2017
12) MOP Order dated 02.07.2020 stating measures to protect the security, integrity and reliability of the strategically important and critical Power Supply System and Network in the Country.
13) CEA (Cyber Security in Power Sector) Guidelines, 2021
14) MNRE guidelines/OM/Advisory/Clarifications
15) And any other applicable standard/regulations

Obtaining connectivity and fulfilment of all the obligations for FTC approval as per connectivity regulation & prescribed procedure by WRLDC/CEA/CERC/CTU/PGCIL/ RLDC/Grid India or any other authorities, for the project (including timely submission of all the required documents for the same) shall be the responsibility of bidder and shall be at the cost of the Contractor.

In case, if the cost is incurred by GSECL then the same shall be reimbursed by Contractor to GSECL. All the necessary compliance at 33 kV level, i.e. Study Reports/Models, additional equipment for reactive power support etc as required by the WRLDC shall be in the scope of Contractor. Any non-compliance and delay in FTC shall be at the cost & risk of Contractor.

As per CEA guidelines for RE generators considering 0.95 PF, the Reactive power Requirement for 100 MW plant would be 33 MVAr. However, as per CEA / WRLDC / MNRE guidelines amended time to time, if Reactive Power compensation is further required at common pooling station of 400 kV level, it shall be provided by GSECL for which Contractor shall co-ordinate with GSECL so as to ensure that there is no delay in FTC clearance. All required technical inputs shall be submitted by Contractor to CTU/ GSECL for capacity assessment of Reactive Power Compensation Equipment. Further, the cost incurred (pro-rata basis) for installation of such equipment shall be in the scope of Contractor and paid by Contractor to GSECL.

The regulations on "Technical Standards for Grid Connectivity" (and subsequent amendments) may be strictly adhered to maintain grid security and the report namely "Data Submission Procedure and Verification of Compliance to CEA Regulations on Technical Standards for Connectivity to the Grid by RE Generators" may also be referred to for this purpose.

First Time Charging (FTC) shall mean the approval from WRLDC for FTC after all the necessary compliance as per prescribed in "procedure of connectivity" of CERC regulation/CEA/WRLDC, i.e. Study Reports, Models, additional equipment for Dynamic Reactive Power Compensators, Benchmarking Reports, Certificates etc as require by the WRLDC shall be solely complied by Solar Project Developer i.e. Contractor.

The Contractor shall be responsible for the delivery of energy conforming Performance Standards for Transmission and Bulk Supply as approved by CERC. The maximum current and voltage waveform distortion shall be in accordance with the limits prescribed

under Central Electricity Authority (Grid Standards) Regulations 2010, as amended from time to time. The contractor shall maintain the Power Factor as per the prevailing CERC regulations and as may be stipulated / specified by CTU/WRLDC from time to time. The Power Producer shall provide suitable protection devices, so that the Electric Generators could be isolated automatically when grid supply fails. Connectivity criteria like short circuit level (for switchgear), neutral Grounding, fault clearance time, current unbalance (including negative and zero sequence currents), limit of harmonics etc. shall be as per Grid Code.

All grid solar PV power projects must install necessary equipment to continuously measure solar radiation, ambient temperature, wind speed and other weather parameters and simultaneously measure the generation of DC power as well as AC power generated from the plant. They will be required to submit this data to GUVNL and MNRE or GEDA on line and/or through a report on regular basis every month for the entire duration of PPA. In this regard they shall mandatorily also grant access to GUVNL and MNRE or GEDA to the remote monitoring portal of the power plants on a 24X7 basis.

14. METERING SYSTEM

“Metering point” - 400 kV side of 400/765 KV Khavda PS-II Pooling Sub-Station of CTU.

Contractor has to provide the quoted generation guarantee (Net exported energy) at Metering point. All losses up to the metering point (400 kV) will be to the account of the Contractor.

However, one more metering system is to be installed at 33 kV side of 400/33 KV Internal Pooling Sub-station where power from the Solar Power Project is injected for measuring export / import from project. Energy recorded in the meter placed at CTU Substation shall be apportioned to each project in the proportion of energy recorded in the meters placed at Pooling Substation.

GSECL shall provide metering system at the at 33 kV side of 400/ 33 kV substation where the power from the solar power project is injected, 400kV side of 400/33kV Internal Pooling substation and at the 400 kV Side of 400/765 kV Khavda PS-II substation of CTUIL. The costs for modifications / changes in metering arising due to modification / amendment in any provision in Regulations, Grid Code, and Central Electricity Authority (Installation and Operation of Meters) Regulations, 2006, or Electricity Act, from time to time, has to be borne by Contractor during contractual period i.e., construction as well as O&M Period. Replacement cost of RTU, PLCC, Park Controller or any other equipment mandated by Grid Code/Regulation shall also be borne by Contractor during contractual period.

A set of Main and Check Meters of 0.2S accuracy class, as per CEA (Installation & operation of meters) Regulations 2019/IEGC amended from time to time as applicable or as specified by power procurer i.e. GUVNL or CTU, shall be Procured and installed by Contractor on each incoming feeder at 33kV side of 33/400 KV Internal Pooling Sub-station.

Another set of Main and Check Meters of 0.2S accuracy class, as per CEA (Installation & operation of meters) Regulations 2019/IEGC amended from time to time as applicable or as specified by power procurer i.e GUVNL, shall be Procured and installed by GSECL on each incoming feeder at 400 kV side of 400/765 kV Grid Sub Station (Interconnection point) of CTUIL based on specifications & make provided by GSECL/ GUVNL/ GETCO/CTUIL.

The Main and Check Meters shall be checked jointly at the time of installation as per the CEA (Installation & Operation of Meters) Regulations 2019 as amended from time to time.

Both sets of meters are used for billing purposes and to measure the transmission line losses up to interconnection point.

Initial capital cost of metering at 33 kV level and 400 kV level has been covered under the capital cost of GSECL Park Development Charges, hence the same shall not be in bidder's scope. However, any changes to be made or any additional requirement for complying with relevant rules, the same shall be conveyed to Contractor to comply or it would be complied by GSECL or CTUIL/PGCIL and cost thereof shall be recovered from Contractor on pro-rata basis. CT / PT input shall be provided by GSECL. However, necessary arrangement / wiring for bringing input shall be in the scope of Contractor. All metering infrastructure at 400 kV side and 33 KV side at GSECL PSS shall be provided by Contractor.

For installation of Meters, Meter testing, Meter calibration and Meter reading and all matters incidental thereto, the Contractor shall follow and be bound by the Central Electricity Authority (Installation and Operation of Meters) Regulations, 2019, and the Grid Code, as amended and revised from time to time.

All the Main and Check Meters shall be calibrated at least once in a period of three years. The Contractor shall bear all costs pertaining to installation, testing, calibration, maintenance, renewal and repair of meters both at 33/400 kV Pooling Sub-Station and 400 / 765 kV grid Sub-Station and shall follow relevant metering requirements as intimated by GSECL.

Interface metering shall conform to the Central Electricity Authority (Installation and Operation of Meters) Regulations 2014 and amendment thereto. CTU may stipulate specifications in this regard. All metering infrastructure at 400 KV side and 33 KV side at GSECL PSS shall be provided by Contractor.

15. FORECASTING, SCHEDULING AND DEVIATION SETTLEMENT

The Successful Bidder shall comply with the CERC regulations on Forecasting, Scheduling and Deviation Settlement, as applicable. All expenses including wheeling / transmission charges and losses, UI / DSM Charges applicable as per GERC / CERC Regulations up to Delivery Point shall be paid by the Contractor during contractual O&M Period without any reimbursement by NHPC.

16. SIGNING OF PPA, IMPLEMENTATION & SUPPORT AGREEMENT (ISA), LAND LEASE AGREEMENT AND CLEARANCE FOR STATUTORY/ REGULATORY CLEARANCES

Letter of Intent (LOI) for supply of power from 200 MW NHPC's Solar PV Power Project to GUVNL has been received on 16.05.2023. The signing of PPA, ISA and Land Lease Agreement will be responsibility of the NHPC and the same shall be signed as per timeline provision provided in Request for Selection of GUVNL.

The Contractor will be responsible for obtaining all required clearances, approvals, permits including connectivity etc. required for setting up the project, commissioning & O&M Period, which are not in the scope of GSECL) from all concerned agencies including State Government and local bodies for smooth project execution to ensure compliances of applicable regulations & statutory approvals.

For GSECL scope of approvals etc, Contractor may refer Request for Selection of GUVNL including all amendments/ clarifications.

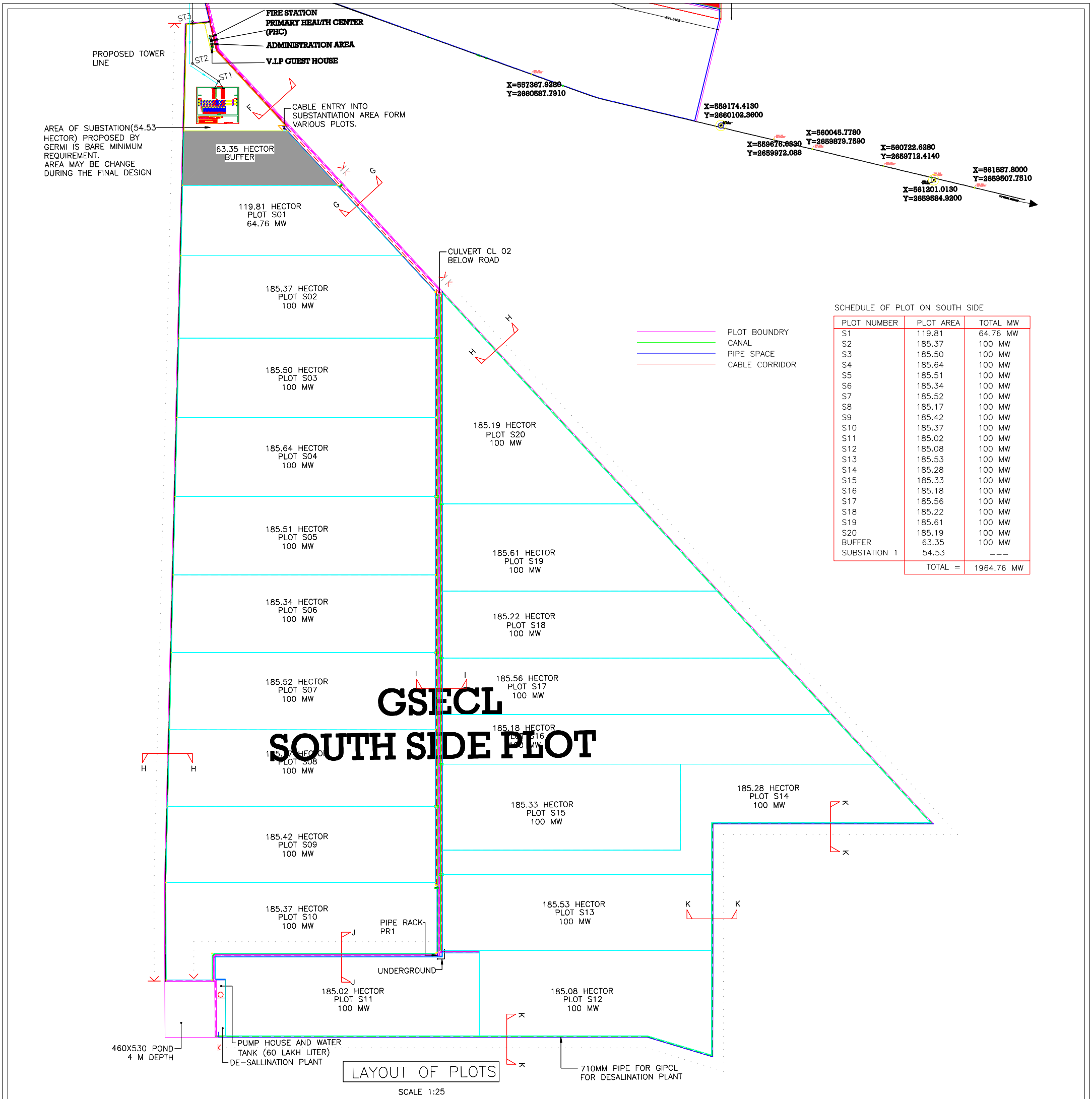
Environment clearance is not required for Solar Park as per MNRE clarification. However, Contractor has to carry out wildlife conservation assessment and shall submit report to Department of Forest, GoG before start of project.

17. SITE VISIT

The bidders, in their own interest, should inspect and examine the site and its surroundings and satisfy themselves, before submitting their tender, in respect of the site conditions including but not restricted to the following which may influence or affect the work or cost thereof under the Contract:

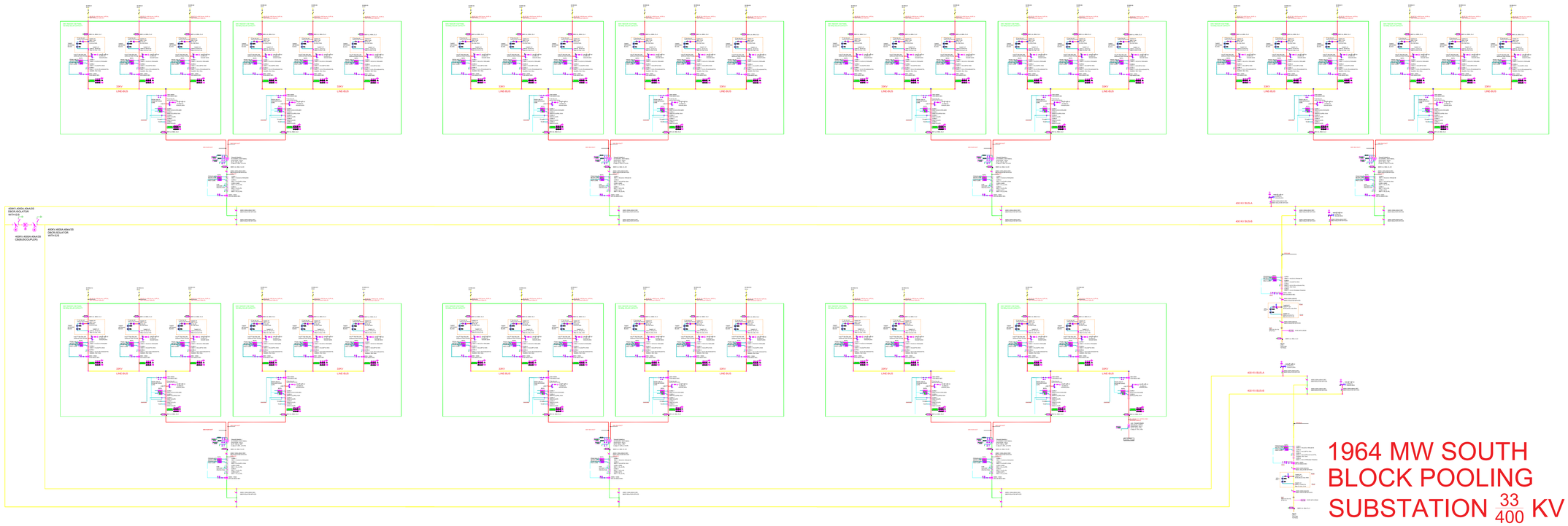
a) Site conditions including access to the site, existing and required roads and other means of transport/ communication for use by them in connection with the works;
b) Requirement and availability of land and other facilities for their enabling works, colonies, stores and workshops etc.
c) Ground conditions including those bearing upon transportation, disposal, handling and storage of materials required for the work or obtained there from;
d) Source and extent of availability of suitable materials including water, etc. and labour (skilled and un-skilled), required for work and Laws and Regulations governing their use and employment;
e) Geological, meteorological, topographical and other general features of the site and its surroundings as are pertaining to and needed for the performance of the work;
f) The limit and extent of surface and sub-surface water to be encountered during the performance of the work and the requirement of drainage and pumping;
g) The type of equipment and facilities needed, preliminary to, for and in the performance of the work; and
h) All other information pertaining to and needed for the work including information as to the risks, contingencies and other circumstances which may influence or affect the work or the cost there of under this contract.
i) Transportation & Logistic constraints etc. to the locations

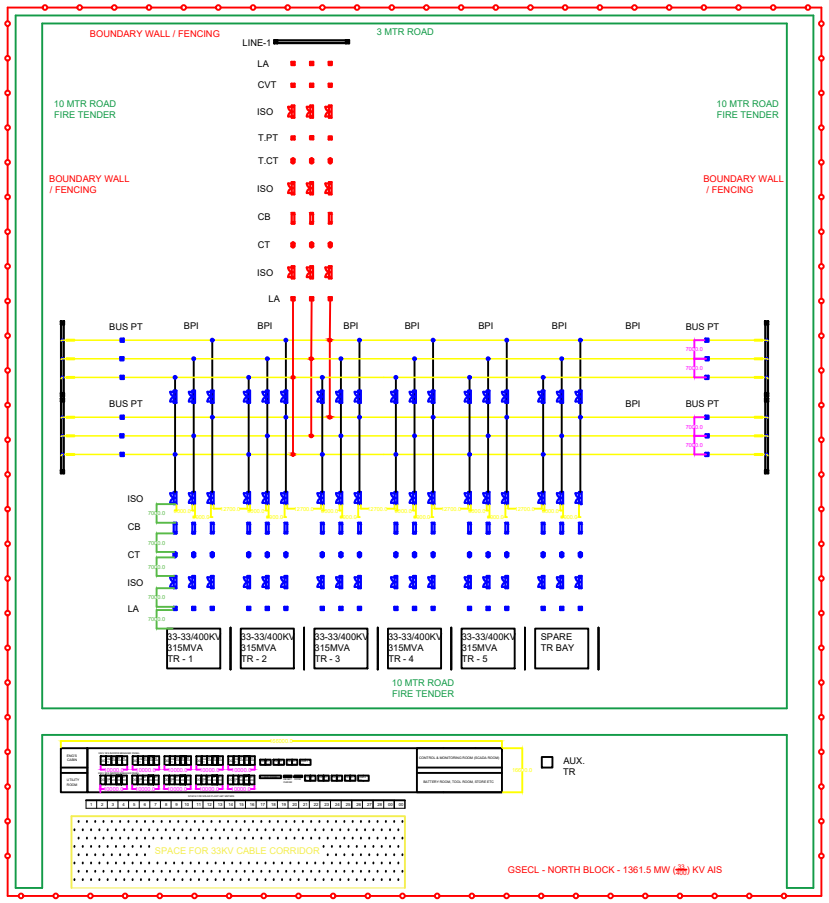
The bidders should note that information, if any, in this tender document, has been given merely to assist the bidders and is not warranted to be complete. The bidders should note and bear in mind that the Employer shall bear no responsibility for the lack of acquaintance of the site and other conditions or any information relating thereto, on their part. The consequences of the lack of any knowledge, as aforesaid, on the part of the bidders shall be at their risk and cost and no charges or claims whatsoever consequent upon the lack of any information, knowledge or understanding shall be entertained or payable by the Employer.

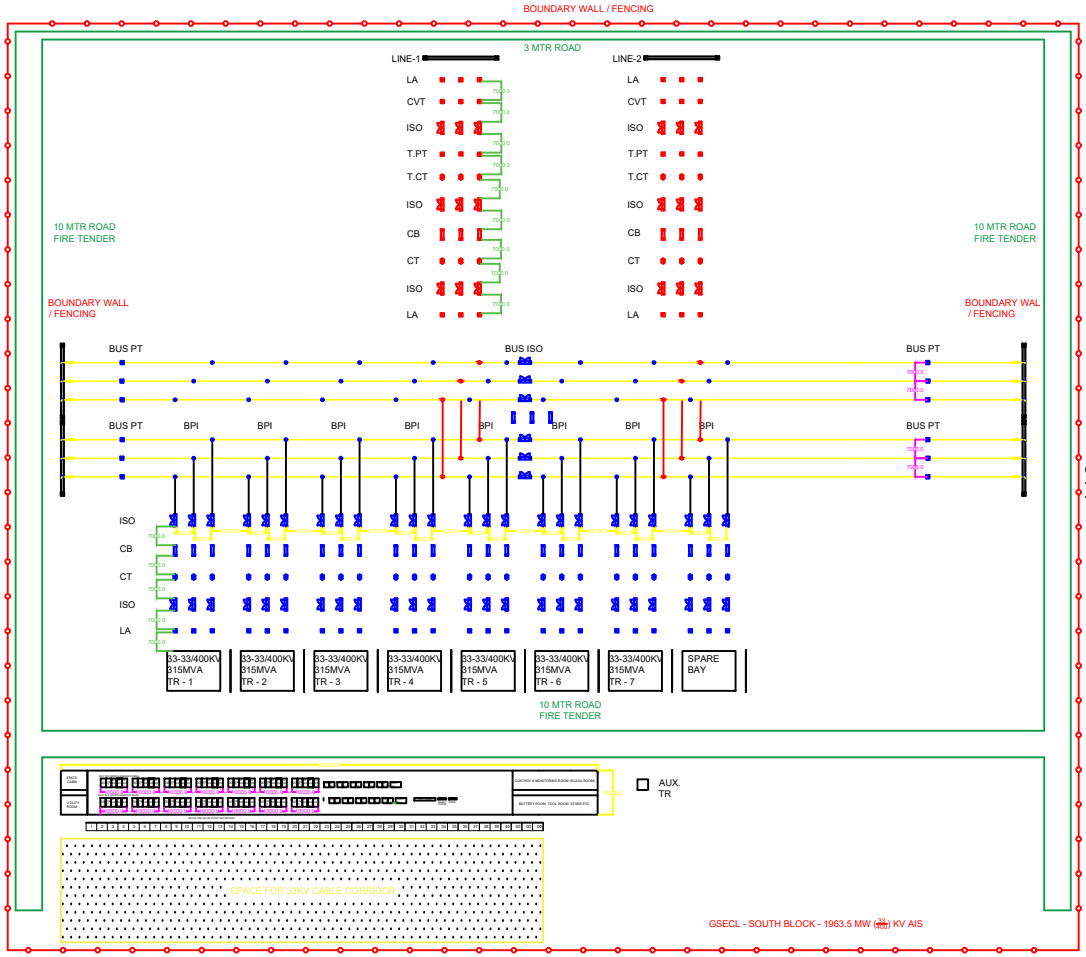


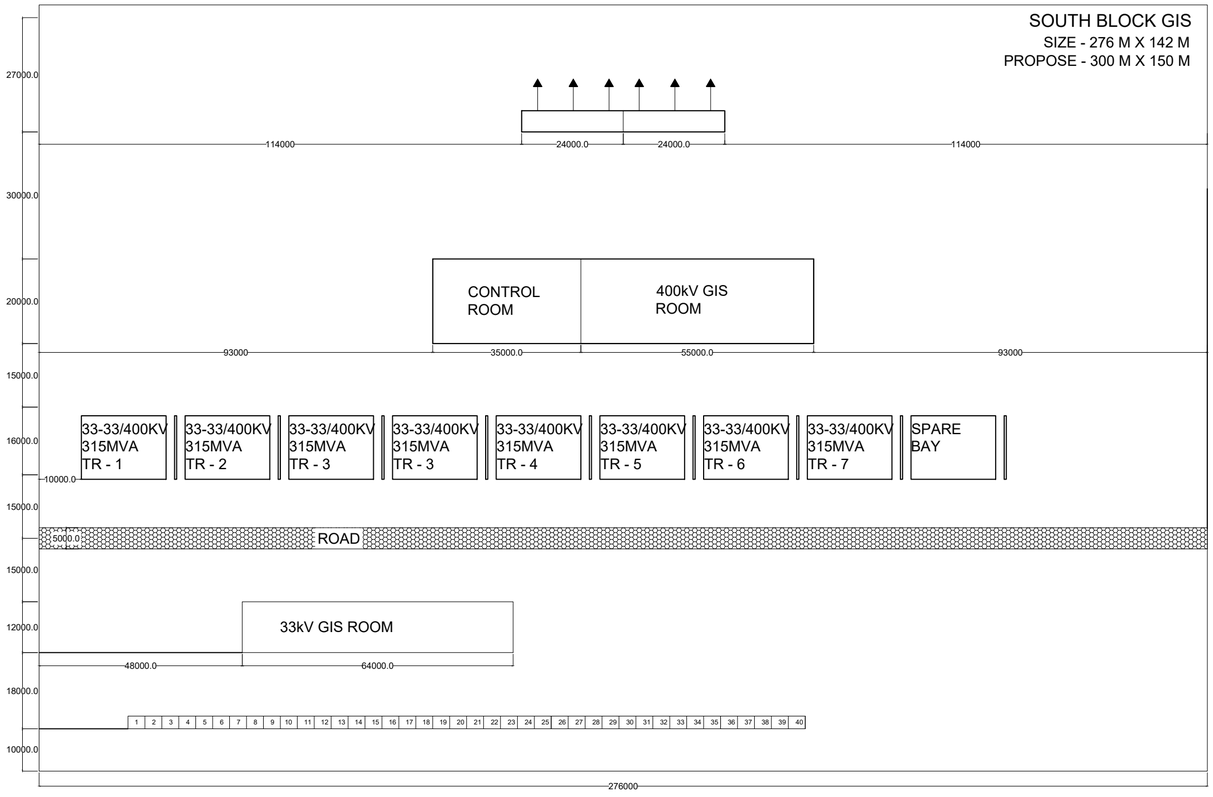
SCHEDULE OF PLOT ON SOUTH SIDE

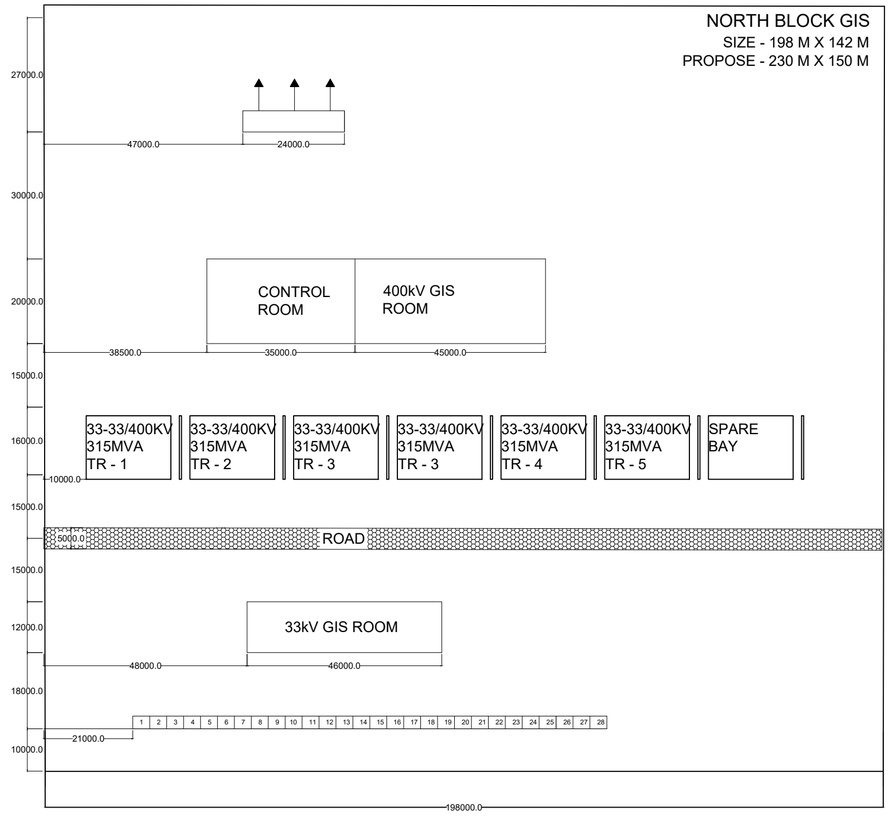
PLOT NUMBER	PLOT AREA	TOTAL MW
S1	119.81	64.76 MW
S2	185.37	100 MW
S3	185.50	100 MW
S4	185.64	100 MW
S5	185.51	100 MW
S6	185.34	100 MW
S7	185.52	100 MW
S8	185.17	100 MW
S9	185.42	100 MW
S10	185.37	100 MW
S11	185.02	100 MW
S12	185.08	100 MW
S13	185.53	100 MW
S14	185.28	100 MW
S15	185.33	100 MW
S16	185.18	100 MW
S17	185.56	100 MW
S18	185.22	100 MW
S19	185.61	100 MW
S20	185.19	100 MW
BUFFER	63.35	100 MW
SUBSTATION 1	54.53	---
	TOTAL =	1964.76 MW


400KV, 400/220 KV,63 MVA,3ϕ AUTO TRANSFORMER


BOUNDARY WALL / FENCING
3 MTR ROAD
LINE-1
LA
CVT
ISO
T.PT
T.CT
ISO
CB
CT
ISO
LA
10 MTR ROAD FIRE TENDER
10 MTR ROAD FIRE TENDER
BOUNDARY WALL / FENCING
BOUNDARY WALL / FENCING
BUS PT
BPI
BUS PT
BUS PT
BPI
BUS PT
ISO
CB
CT
ISO
LA
33-33/400KV 315MVA TR - 1
33-33/400KV 315MVA TR - 2
33-33/400KV 315MVA TR - 3
33-33/400KV 315MVA TR - 4
33-33/400KV 315MVA TR - 5
SPARE TR BAY
10 MTR ROAD FIRE TENDER
AUX. TR
SPACE FOR 33KV CABLE CORRIDOR
GSECL - NORTH BLOCK - 1361.5 MW (220) KV AIS


BOUNDARY WALL / FENCING
3 MTR ROAD
LINE-1
LINE-2
LA
CVT
ISO
T.PT
T.CT
ISO
CB
CT
ISO
LA
10 MTR ROAD FIRE TENDER
10 MTR ROAD FIRE TENDER
BOUNDARY WALL / FENCING
BOUNDARY WAL / FENCING
BUS PT
BUS ISO
BUS PT
BUS PT
BPI
BUS PT
ISO
CB
CT
ISO
LA
33-33/400KV 315MVA TR - 1
33-33/400KV 315MVA TR - 2
33-33/400KV 315MVA TR - 3
33-33/400KV 315MVA TR - 4
33-33/400KV 315MVA TR - 5
33-33/400KV 315MVA TR - 6
33-33/400KV 315MVA TR - 7
SPARE BAY
10 MTR ROAD FIRE TENDER
AUX. TR
SPACE FOR 33KV CABLE CORRIDOR
GSECL - SOUTH BLOCK - 1963.5 MW (220) KV AIS


SOUTH BLOCK GIS
SIZE - 276 M X 142 M
PROPOSE - 300 M X 150 M
27000.0
114000
24000.0
24000.0
114000
30000.0
CONTROL ROOM
400kV GIS ROOM
20000.0
93000
35000.0
55000.0
93000
15000.0
33-33/400KV 315MVA TR - 1
33-33/400KV 315MVA TR - 2
33-33/400KV 315MVA TR - 3
33-33/400KV 315MVA TR - 3
33-33/400KV 315MVA TR - 4
33-33/400KV 315MVA TR - 5
33-33/400KV 315MVA TR - 6
33-33/400KV 315MVA TR - 7
SPARE BAY
16000.0
10000.0
15000.0
5000.0
ROAD
15000.0
33kV GIS ROOM
12000.0
48000.0
64000.0
18000.0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
10000.0
276000


NORTH BLOCK GIS
SIZE - 198 M X 142 M
PROPOSE - 230 M X 150 M
27000.0
47000.0
24000.0
30000.0
CONTROL ROOM
400kV GIS ROOM
20000.0
38500.0
35000.0
45000.0
15000.0
33-33/400KV 315MVA TR - 1
33-33/400KV 315MVA TR - 2
33-33/400KV 315MVA TR - 3
33-33/400KV 315MVA TR - 3
33-33/400KV 315MVA TR - 4
33-33/400KV 315MVA TR - 5
SPARE BAY
16000.0
10000.0
15000.0
5000.0
ROAD
15000.0
33kV GIS ROOM
12000.0
48000.0
46000.0
18000.0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28
21000.0
10000.0
198000.0

VOLUME 2 - PART A:
GENERAL CONDITIONS OF CONTRACT (GCC)

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Notes on the General Conditions of Contract

The General Conditions of Contract in Volume 2: PART-A, read in conjunction with the Special Conditions of Contract in Volume 2: PART-B and other documents listed therein, is a complete document expressing all the rights and obligations of the parties.

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GENERAL CONDITIONS OF CONTRACT (GCC)
A. Contract and Interpretation

1. **Definitions**

1.1 The following words and expressions shall have the meanings hereby assigned to them:

1.2Acts / Codes shall mean, but not limited to the following, including the latest amendmentsand/or replacements, if any:-

- Electricity Act, 2003 with amendments thereto if any.
- A.I.E.E Test Codes.
- American Society of Testing of Materials (ASTMCodes).
- Relevantstandardsofthe Bureau ofIndian Standards(ISCodes)
- Arbitration and Conciliation Act, 1996, and Rules made thereunder.
- Environment (Protection) Act, 1986 and Rules made there under.
- Other approved standards and/or Rules and Regulations touching the subject matter of the Contract.

1.3`Approved'means approval in writing including subsequent written confirmation of previous verbal approval.

1.4'Bill of Quantities' (BOQ) or **'Price Schedules'** or **'Schedules'** means the bill of quantities included in the contract(s) for the Works.

1.5'Certificate of Completion' means the certificate(s) to be issued according to GCC 24.0 hereof.

1.6'Commercial Operation Date (COD)'means the date on which the last *Solar Array of the respective unitsfor Solar Power Project* is synchronized with the Grid system & the system remains in operation thereafter. The commissioning certificate issued by DISCOM shall confirm such date of commercial operation.

1.7"Commissioning of Project" shall mean the commissioning of entire *Solar Power Project including* commissioning of each Solar Array, its interfacing with State Grid and commencement of export of electrical energy to the grid (as specified in the certificate issued by State Nodal Agency / State Transmission Company), successful completion of trial run and acceptance by owner.

1.8"Completion (Period)" of *Setting up of 200 MW Solar PV Power Project in 600 MW in Solar park (Stage-1) of Gujarat State Electricity Corporation Ltd. (GSECL) at Khavda, Gujarat* is 15 (Fifteen) months from the start date as mentioned in Letter of Award as defined in Appendix-4 (Time Schedules).

1.9'Consignee'means Employer's authorized representative.

1.10"Contract Documents" means the documents listed in Article 1.1 (Contract Documents) of the Form of Contract Agreement (including any amendments thereto).

1.11"Contract Price" means the sum specified in Article 2.1 (Contract Price) of Contract Agreement.

1.12"Contract" means the Contract entered into between the Employer and the Contractor, together with the Contract Documents referred to therein; they shall constitute the Contract, and the term "the Contract" shall in all such documents be construed accordingly.

1.13"Contractor's Equipment" means all plant, facilities, equipment, machinery, tools, apparatus, appliances or things of every kind required in or for transportation, installation, completion and maintenance of Facilities that are to be provided by the Contractor, but does not include Plant and Equipment, or other things intended to form or forming part of the Facilities.

1.14"Contractor's Representative" means any person nominated by the Contractor and approved by the Employer in the manner provided in GCC Sub-Clause 17.2 (Contractor's Representative and Construction Manager) hereof to perform the duties delegated by the Contractor.

1.15"Contractor" means the person(s) whose bid to perform the Contract has been accepted by the Employer and is named as such in the Contract Agreement, and includes the legal successors or permitted assigns of the Contractor.

1.16"Day" means calendar day of the Gregorian calendar.

1.17"Defects Liability Period (DLP)" shall mean the period during which the Contractor is responsible for remedying the defects with respect to the Facilities (or relevant part thereof) of Solar Power Project, after commissioning, as provided in Clause 27 of GCC.

1.18'DISCOM'means 'Concerned Distribution Utility of the State.

1.19'**Drawings','Plans'**, shall mean engineering data and drawings submitted by the Contractor with his bid and/or during the progress of the work provided such drawings are acceptable to the Engineer/Employer.

1.20"Effective Date" means from the date of issue of Notification of Award/Letter of Acceptance.

1.21"Employer" or "Owner" or "NHPC" means NHPC Ltd.and includes the legal successors or permitted assigns of the Employer.

1.22"Engineer/Engineer In-Charge" means the person appointed by the Employer in the manner provided in GCC Sub-Clause 17.1 (Engineer In-Charge) hereof and named as such in the GCC to perform the duties delegated by the Employer.

1.23"Facilities" or "Works" means the Plant and Equipment to be supplied and installed, all works to be executed, all items & things to be supplied/done as well as all the Installation Services including design, fabrication, manufacture, supply, transportation, erection, testing and commissioning together with operation and

maintenance works to be carried out by the Contractor under the Contract.

1.24"GCC" means the General Conditions of Contract hereof.

1.25"Guarantee Test(s)" means the test(s) specified in the SCC / Technical Specifications to be carried out to ascertain whether the Facilities or a specified part thereof is able to attain the Functional Guarantees specified therein in accordance with the provisions of GCC Sub-Clause 25.2 (Guarantee Test) hereof.
1.26'Independent External Monitor(s) (IEMs)' means the External Monitor(s) appointed by the Employer to oversee the implementation of Integrity Pact.

1.27'Integrity Pact' means the Pact signed between the Employer and Contractor committing the persons/officials of both the parties, not to exercise any corrupt influence on any aspect of the Tender/Contract.

1.28"Installation Services" means all those services ancillary to the supply of the Plant and Equipment for the Facilities, to be provided by the Contractor under the Contract; e.g., transportation and insurance, inspection, expediting, Site preparation works (including the provision and use of Contractor's Equipment and the supply of all construction materials required), installation, testing, Pre-commissioning, commissioning, operations, maintenance, the provision of operations and maintenance manuals, training, etc., as the case may be.

1.29'**Manufacturer's work'or'Contractor'swork'**shall mean the place of work used by the Contractor for the performance of the Contract.

1.30'Metering Point'means the point at which the State Power Utility/Electricity Board measures the quantity of energy supplied to its grid.

1.31'NODAL AGENCY' means 'Agency of the Centre/State'.

1.32'O&M' shall mean Operation & Maintenance of "***Setting up of 200 MW Solar PV Power Project in 600 MW in Solar park (Stage-1) of Gujarat State Electricity Corporation Ltd. (GSECL) at Khavda, Gujarat"*** which interalia, includes provisions of manpower, spares, special tools, cranes or such materials/equipments that may be required for maintaining the solar power project and solar park in operation including power evacuation system.

1.33"Operational Acceptance" means the acceptance by the Employer of the Facilities (or any part of the Facilities where the Contract provides for acceptance of the Facilities in parts), which certifies the Contractor's fulfilment of the Contract in respect of Functional Guarantees of the Facilities (or the relevant part thereof) in accordance with the provisions of GCC Clause 28 (Functional Guarantees) hereof and shall include deemed acceptance in accordance with GCC Clause 25 (Commissioning and Operational Acceptance) hereof.

1.34Party: means the Employer or the Contractor as the context requires and Parties means both of them.

1.35'**Performance and GuaranteeTest'** shall mean all operational checks and tests required to determine and demonstrate capacity, efficiency, and operating characteristics as specified in the contract document.

1.36'Person'shall include firms, companies, corporations and associations or bodies individuals, whether incorporated or not.

1.37'**Singular'** or '**masculine '**includes'**plural'**or '**feminine'** and vice-versa in their respective context.

1.38"Plant and Equipment" means permanent plant, equipment, machinery, apparatus, materials articles and things of all kinds to be provided and incorporated in the Facilities by the Contractor under the Contract, but does not include Contractor's Equipment.

1.39'Project'shall mean "***Setting up of 200 MW Solar PV Power Project in 600 MW in Solar park (Stage-1) of Gujarat State Electricity Corporation Ltd. (GSECL) at Khavda, Gujarat."***

1.40'Prudent Utility Practice'means accepted international / Indianpractice(s), standard(s), engineering and operation considerations,taking into account the conditions prevalent at Site including manufacturer's recommendations generally followed in the operation and maintenance of facilities similar to the power plant.

1.41"SCC" means the Special Conditions of Contract.

1.42"Site" means the land and other places upon which the Facilities are to be installed and such other land/water body or places as may be specified in the Contract as forming part of the Site.

1.43'Specification', or **Technical Specifications** or **'Employer's Requirement'**shall mean theTechnical specifications forming a part of the contract and such other schedules as may be mutually agreed upon.

1.44'Subcontractor" including vendors, means any person to whom execution of any part of the Facilities, including preparation of any design or supply of any Plant and Equipment, is sub-contracted directly or indirectly by the Contractor, and includes its legal successors or permitted assigns.

1.45"Time for Completion" means the time within which Completion of the Facilities as a whole and O&M period is to be attained in accordance with the stipulations in Appendix -4 of Volume -5 (Forms & procedures).

1.46'TRANSCO'means 'StateTransmission Company or Corporation'.

1.47'Writing' shall include any manuscript, type written or printed statement, underorover signature of the authorized representative of Employer/Contractor and/or seal as the case maybe.

1.48'Year' means 365 days.

1.49"Independent Engineer" means the expert jointly selected by the Employer and the Contractor for Dispute Avoidance Mechanism under Sub-Article 38.2 from the panel of experts maintained & issued by the Ministry of Power, Govt. of India vide OM no. 15-18/ 1/2020-HYDEL-II(MoP)-Part(1) dated 29.11.2021 or as amended from time to time.

1.50Conciliation Committee of Independednt Experts (CCIE): Conciliation Committee of Independednt Experts (CCIE) constituted by the Ministry of

Power, Govt. of India vide Office Memorandum F. No. 11/22/2021-Th.II dated 22.03.2022 or as amended from time to time for settlement of disputes arising in contracts through Conciliation Mechanism.

2. **Contract Documents**

Subject to Article 1.2 (Order of Precedence) of the Contract Agreement, all documents forming part of the Contract (and all parts thereof) is intended to be correlative, complementary and mutually explanatory. The Contract shall be read as a whole.

3. **Interpretation**

3.1 **Language**

3.1.1 The language of the Contract shall be English. All further documents, all correspondences and communications to be given in respect of the Contract shall be in English. The Employer's representative and the Contractor's representative shall be fluent in English.

3.1.2 If any of the Contract Documents, correspondence or communications are prepared in any language other than the governing language under GCC Sub-Clause 3.1.1 above, the English translation of such documents, correspondence or communications shall prevail in matters of interpretation.

3.2 **Interpretation:**

In the Contract, except where the context requires otherwise:

(a) words indicating one gender include all genders;

(b) words indicating the singular also include the plural and words indicating the plural also include the singular;

(c) provisions including the word "agree," "agreed," or "agreement" require the agreement to be recorded in writing;

(d) the word "tender" is synonymous with "bid," "tenderer," with "bidder," and "tender documents" with "bidding documents," and

"Written" or "in writing" means hand-written, type-written, printed or electronically made, and resulting in a permanent record.

3.3 **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 **Persons**

Words importing persons or parties shall include firms, corporations and

government entities.

3.5 **Deleted**

3.6 **Entire Agreement**

The Contract constitutes the entire agreement between the Employer 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.

3.6.1 Construction of the Contract

The Contract to be entered into with the successful Bidder shall be as detailed below:

Contract for "*Setting up of 200 MW Solar PV Power Project in 600 MW in Solar park (Stage-1) of Gujarat State Electricity Corporation Ltd. (GSECL) at Khavda, Gujarat."*

3.6.2 After initial 05 years of O&M Period, the O&M Contract may be renewed further at mutually agreed terms and conditions. However, the renewal process should be completed before completion of the O&M period.

3.6.3 Deleted.

3.6.4 In case of Contracts for EPC works entered into as above or where the Employer hands over his equipment to the Contractor for executing the Contract, then the Contractor shall, at the time of taking delivery of the equipment through Bill of Lading or other dispatch documents, furnish Trust Receipt for Plant, Equipment and Materials and also execute an Indemnity Bond in favour of the Employer in the form acceptable to the Employer for keeping the equipment in safe custody and to utilize the same exclusively for the purpose of the said Contract. Samples of proforma for the Trust Receipt and Indemnity Bond are enclosed under Vol.5: Forms and Procedures. The Employer shall also issue a separate Authorization Letter to the Contractor to enable him to take physical delivery of plant, equipment and materials from the Employer as per proforma enclosed under Section Vol.5: Forms and Procedures. The Contractor shall submit an indemnity Bond to the Employer in the Form 7 indemnifying against all omissions and commissions committed by the Contractor or its failure to abide by or violating the terms & conditions relating to the customs clearance, if any as per GCC Clause 21.3 or any provisions of Custom Tariff Act 1975 (with latest amendments), whatsoever.

3.6.5 The total responsibility with respect to design, timely execution, including completion, guarantee liabilities and all other contractual obligations will remain with Contractor irrespective of the modality of ordering and the Contractor shall coordinate all activities for smooth and timely completion of the order in such a manner, as if there has been no split in the scope of Facilities.

3.6.6 The Contract will be signed in three originals and the Contractor shall be provided with one signed original and the rest will be retained by the Employer.

3.6.7 Subsequent to signing of the Contract, the Contractor at his own cost shall provide the Employer with ten (10) true copies of Contract within thirty (30) days after signing of the Contract.

3.7 **Amendment**

No amendment or other variation of the Contract shall be effective unless it is in writing, is dated, expressly refers to the Contract, and is signed by a duly authorized representative of each party hereto.

3.8 **Independent Contractor**

The Contractor shall be an independent contractor performing the Contract. The Contract does not create any agency, partnership, joint venture or other joint relationship between the parties hereto.

Subject to the provisions of the Contract, the Contractor shall be solely responsible for the manner in which the Contract is performed. All employees, representatives or Subcontractors engaged by the Contractor in connection with the performance of the Contract shall be under the complete control of the Contractor and shall not be deemed to be employees of the Employer, 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 Subcontractors and the Employer.

3.9 **Non-Waiver**

3.9.1 Subject to GCC Sub-Clause 3.9.2 below, 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.

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

3.10 **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.

3.11 **Place of Origin**

"Origin" means the place where the materials, equipment, plants & component parts and other supplies for the Facilities are mined, grown, produced or manufactured, and from which the services are provided.

4. **Notices**

4.1 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, airmail post, special courier, facsimile or Electronic Data Interchange (EDI)/ email to the address of the relevant party, with the following provisions.

4.1.1 Any notice sent by facsimile or EDI/ Email shall be confirmed within two (2) days after dispatch by notice sent by airmail post or special courier, except as otherwise specified in the Contract.

4.1.2 Any notice sent by airmail post or special courier 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 or courier service for transmission by airmail or special courier.

4.1.3 Any notice delivered personally or sent by facsimile or EDI/ Email shall be deemed to have been delivered on date of its dispatch.

4.1.4 Either party may change its postal, facsimile or EDI/ Email address or addressee for receipt of such notices by ten (10) days' notice to the other party in writing.

4.2 Notices shall be deemed to include any approvals, consents, instructions, orders and certificates to be given under the Contract.

5. **Governing Law**

5.1 The Contract shall be governed by and interpreted in accordance with laws of India.

5.2 In respect of all matters or actions arising out of the Contract and which may arise at any time, the Courts at Faridabad shall have jurisdiction, subject to Clause 6.0 thereof (Settlement of Disputes).

6. **Settlement of Disputes.**

6.1 **Independent Engineer (IE) for Dispute Avoidance Mechanism**

6.1.1 **Appointment of the Independent Engineer (IE) for Dispute Avoidance Mechanism**

Contentious issue / Disagreement shall be resolved through Dispute Avoidance Mechanism through Independent Engineer in accordance with Sub-Article 38.4 [Obtaining Independent Engineer's Decision].

The Owner & Contractor shall jointly appoint one Member only from the panel of Experts empanelled and approved by the Ministry of Power, Govt. of India vide OM no. 15-18/1/2020-HYDEL-II(MoP)-Part(1) dated 29.11.2021 (**GCC Annexure II**) or as amended from time to time as "Independent Engineer" for the works. The Expert would be designated as 'Independent Engineer' (IE) for the contract. The

Independent Engineer shall be appointed within 28 days from the date of order to commence.

The initial term of appointment of Independent Engineer would be for a period of five (5) years or contract period whichever is lesser and may be further renewed on a year-on-year basis as may be mutually agreed between the Owner and the Contractor subject to the consent of Independent Engineer from the panel of experts notified vide OM no. 15-18/1/2020-HYDEL-II (MoP)-Part(1) dated 29.11.2021 or as amended from time to time.

It will be mandatory for the Independent Engineer to visit the site once in every two months to be constantly aware of the ongoing project activities and to have a fair idea of any situation that may lead to disagreement between the parties. Further, additional visits may also be undertaken as and when called upon to address issues of disagreements.

Owner or Contractor will not be able to change the Independent Engineer in any case. In case of adverse finding about Independent Engineer such as not performing duties or complaints of integrity, that Expert would be dropped by the Ministry from the panel itself and a new Expert would be selected by the Owner and Contractor jointly from the panel for performing the duties of Independent Engineer.

The terms of appointment and remuneration of Independent Engineer shall be governed as defined in **GCC ANNEXURE-I**.

6.1.2 **DELETED**

6.1.3 **OBTAINING INDEPENDENT ENGINEER (IE) DECISION**

If a Contentious issue / disagreement (of any kind whatsoever) arises between the Owner and Contractor in connection with, or arising out of, the Contract or the execution of the Works, including any certificate, determination, instruction, opinion or valuation of the Engineer, either Party may refer the dispute in writing to the Independent Engineer for its decision, with copies to the other Party. Such reference shall state that it is given under this Sub-Clause.

The Owner and Contractor shall use their best efforts to settle the disagreements / disputes arising out of or in connection with this contract or the interpretation thereof.

The Independent Engineer shall act as per Standard Operating Procedure (SOP) (issued by the Ministry of Power vide Office Memorandum no. 15-18/1/2020-HYDEL-II(MoP) dated 27.09.2021 or

as amended from time to time) attached at **GCC ANNEXURE-I**.

Both Parties shall promptly make available to the Independent Engineer all such information, further access to the Site, and appropriate facilities, as the Independent Engineer may require for the purposes of making a decision on such dispute/ disagreement and non-compliance of same shall lead to imposition of penalty @ 0.005% of amount of dispute disagreement referred to Independent Engineer or Rs. 5000/- whichever is higher for each day of delay.

Decision of Independent Engineer shall be accepted by both the parties subject to other available provisions in this contract, if any, if the parties so desire .

6.1.4 DELETED

6.1.5 **DELETED**

6.1.6 **DELETED**

6.2 **Amicable Settlement**

6.2.1 If any dispute arises between the Employer and the Contractor in connection with, or arising out of the Contract or the execution of the Works, whether during the execution of the Works or after their completion and whether before or after the repudiation or after termination of Contract, including any disagreement by either party with any action, inaction, opinion, instruction, determination, certificate or valuation of the Employer, an attempt shall be made to resolve the matter in dispute amicably.

6.2.2 Any dispute, in respect of which the Employer and the Contractor have failed to reach at an amicable settlement pursuant to GCC Clause 6.2, shall be finally settled by reference to arbitration/-Conciliation Committee of Independent Expert (CCIE) as per clause 6.3/6.4. The Arbitration and Conciliation Act, 1996, as amended up to date, shall govern the arbitration.

6.3 **Arbitration**

6.3.1 Except as otherwise provided in clause-6.1, 6.2 above, hereinbefore, all questions, dispute or difference in respect of which the decision has not been final and conclusive arising between the Contractor and the Employer, in relation to or in connection with the Contract shall be referred for arbitration in the manner provided as under:

6.3.2 Any dispute or difference what so ever arise between the Parties and of or relating to the construction, interpretation, application, meaning, scope, operation /or effect of this Contract or validity of the breach thereof, shall after written notice by either Party to the other be referred for adjudication and such dispute or difference shall be settled in accordance with the Arbitration and Conciliation Act, 1996 or any statutory amendment thereof,

as set forth below:

(i) The arbitral tribunal shall consist of 3 arbitrators, one each to be appointed by the Employer and the Contractor. The third Arbitrator shall be chosen by the two Arbitrators so appointed by the Parties and shall act as presiding arbitrator. In case of failure of the two arbitrators, appointed by the parties to reach upon a consensus within a period of 30 days from the appointment of the arbitrator appointed subsequently, the Presiding arbitrator shall be appointed by the President of the Institution of Engineers (India).

(ii) If one of the parties fail to appoint its arbitrator in pursuance of subclause (i) and (ii) above, within 30 days after receipt of the notice of appointment of its arbitrator by the other party, then the President of Institution of Engineers (India) shall appoint the arbitrator. A certified copy of the order of the President of Institution of Engineers (India), making such an appointment shall be furnished to each of the parties.

(iii) The decision of the majority of arbitrators shall be final and binding upon both parties.

(iv) The fee payable to arbitrators shall be as per the model fee structure of NHPC, the present modal fee structure is placed at GCC Annexure-III. The fees include the sitting fee of arbitrators, reading fee, award writing fee and secretarial expenses etc. and nothing is payable other than this by whatsoever name called. The cost and expenses of Arbitration shall be borne in such a manner as determined by the arbitral tribunal. However, the expenses incurred by each party in connection with the preparation, presentation, etc. of its proceedings as also the fees and expenses paid to the arbitrator appointed by such party or on its behalf shall be borne by each party itself.

(v) The seat of Arbitration shall be at Faridabad.

The cumulative claims amounting upto Rs. ten (10) Crore can only be referred to arbitration and the claims beyond Rs. ten (10) Crore, parties can refer to either Conciliation Committee of Independent Experts (CCIEs) or Arbitration. All meetings of the Conciliation Committee shall be held at NHPC Ltd, Corporate Office, Sector-33, Faridabad, Haryana.

The court at Faridabad shall have exclusive jurisdiction on the disputes arising out of the contract.

6.3.3 It is a term of the Contract that the Party invoking arbitration shall specify all disputes to be referred to arbitration at the time of invocation of arbitration and not thereafter.

6.3.4 Notwithstanding any reference to the Arbitration herein,

(a) the parties shall continue to perform their respective obligations

under the Contract unless they otherwise agree.

(b) the Employer shall pay to the Contractor any moneys due to the Contractor.

(c) the party invoking arbitration shall have to deposit a sum equal to 5% of the amount claimed under dispute with the other party at the time of invocation of arbitration clause. The amount of 5% should be deposited in Demand Draft / NEFT / RTGS and no other security such as bank Guarantee etc. will be accepted against this amount. The amount so deposited shall be adjusted against costs, if any, awarded by the Arbitral Tribunal against the claimant party and the balance remaining after such adjustment and in the absence of any such costs being awarded, the whole of the sum will be refunded to the party within one month from the date of the award. A simple interest @ 6% per annum shall be paid by the other party on the amount deposited by the party for referring the claim to arbitration.

In case of contract with another Central Public Sector Enterprises (CPSEs) inter se and CPSE(s) and Government Department(s) / Organization(s) (excluding disputes related to Railways, Income Tax, Customs & Excise Departments), the above said clauses 6.3.1 to 6.3.4 shall stand deleted and the following Arbitration clause shall be applicable: -

(i) "In the event of any dispute or difference relating to the interpretation and application of the provisions of commercial contract(s) between Central Public Sector Enterprises (CPSEs)/ Port Trusts inter se and also between CPSEs and Government Department/Organization (excluding disputes related to Railways, Income Tax, Customs & Excise Departments), such dispute or difference shall be taken up by either party for its resolution through AMRCD as mentioned in DPE OM No. 05/0003/2019-FTS-10937 dated 14th December, 2022 (copy enclosed as **Annexure-VI**) and the decision of AMRCD on the said dispute will be binding on both the parties."

(ii) Both the Employer and Contractor (CPSE/Government Department) shall refer the existing dispute(s) to the Arbitrator at the earliest.

(iii) The Arbitrator shall make a speaking award.

(iv) The work under this Contract shall continue during Resolution proceedings and no payments due from or payment by the Corporation shall be withheld on account of such proceedings except to the extent which may be in dispute.

Note: This provision is applicable to disputes with Central PSEs / Port Trusts / Government Department(s) / Organization(s) (excluding disputes related to Railways, Income Tax, Customs & Excise Departments) only.

6.4 Dispute Resolution through Conciliation Committee of Independent Experts (CCIEs):

6.4.1 Conciliation Committee of Independent Experts constituted by the Ministry of Power, Govt. of India vide Office Memorandum F. No. 11/22/2021-Th.II dated 22.03.2022 (**GCC Annexure-IV**) or as amended from time to time for settlement of disputes arising in contracts through

Conciliation Mechanism.

6.4.2 Dispute Resolution through Conciliation Committee of Independent Experts (CCIEs) as notified by the Ministry of Power, Govt. of India vide Office Memorandum F. No. 11/22/2021-Th.II dated 29.12.2021 (**GCC Annexure-V**) or as amended from time to time is available for resolution of contractual disputes.

The disputes amounting above Rs. Ten (10) Crore shall only be referred for Conciliation through Conciliation Committee of Independent Experts (CCIEs).

All meetings of the Conciliation Committee shall be held at NHPC Ltd, Corporate Office, Sector-33, Faridabad, Haryana.

6.4.3 Process of appointment, Broad Terms and Conditions and Standard operating procedure for the proceedings of Conciliation Committee of Independent Experts (CCIEs) shall be as per the **GCC Annexure-V**.

6.5 However, any issue or matter relating to tendering stage including negotiations (if any) at that stage which has been mutually agreed and incorporated in the Contract shall not be entertained in any dispute resolution mechanism/courts.

6.6 Simple interest @ 6.0 % per annum shall be payable on the awarded amount of the dispute/claim for the pre reference and pendente period.

B. Subject Matter of Contract

7. Scope of Facilities

7.1 Unless otherwise expressly limited in the Technical Specification the Contractor's obligations cover the provision of all Plant and Equipment and the performance of all Installation Services required for the design, the manufacture (including procurement, quality assurance, installation, all Civil Works, Pre-commissioning and delivery) of the Plant and Equipment and the installation, completion, commissioning, performance testing and operation and maintenance of the Facilities 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 and accessories; Contractor's Equipment; temporary materials, structures and facilities; transportation (including, without limitation, unloading and hauling to, from and at the Site); and storage, all works to be executed, all items and things to be supplied for setting up and operation and maintenance of the "Project".

7.2 The Contractor shall, unless specifically excluded in the Contract, perform all such work 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 Completion of the Facilities as if such work and/or items and materials were expressly mentioned in the Contract.

7.3 The Contractor shall carry sufficient inventories to ensure an ex-stock supply of consumable spares for the plant and equipment. Other spare parts and components shall be supplied as promptly as possible, but at the most within six (6) months or

in case of long lead item duration to be mutually agreed, of placing the order. In addition, in the event of termination of the production of spare parts, advance notification will be made to the Employer of the pending termination, with twelve (12) months' time to permit the Employer to procure the needed requirement. Following such termination, the Contractor will permit to the extent possible and at no cost to the Employer the blueprints, drawings and specifications of the spare parts, if requested.

8. **Time for Commencement and Completion**

8.1 The Contractor shall commence work on the Facilities as per the date of start as stated in the Notification of award and shall thereafter proceed with the Facilities in accordance with the time schedule specified in Appendix 4 (Time Schedule) to the Contract Agreement. If the Contractor commits default in the commencement of work within 30 days of issue of Letter of Acceptance, the Engineer-in-Charge shall without prejudice to any other right or remedy be at liberty to cancel the Contract and forfeit the earnest money/Performance Guarantee.

8.2 The Contractor shall attain Completion of the Facilities within the time stated in the Contract or within such extended time to which the Contractor shall be entitled under GCC Clause 40 (Extension of Time for Completion) hereof.. Land development and road maintenance shall be in the scope of contractor.

9. **Contractor's Responsibilities**

9.1 (i) The Contractor shall provide at his own cost all temporary pathways/roads required at site as defined in Technical Specifications and shall alter, adopt and maintain the same as required from time to time and shall bear all expenses and charges for special or temporary way required by him in connection with access to the site and shall take up and clear them away and make good all damages done to the site as and when no longer required and as and when ordered by the Engineer-in-Charge. The Contractor shall also obtain at his risk and cost, any additional facilities outside the site which he may require for the purpose of the Works.

(ii) The Contractor shall not interfere unnecessarily or improperly with:

a) the convenience of the public, or .
b) the access to and use and occupation of all roads and footpaths, irrespective of whether they are public or in the possession of the Employer or of others.

The Contractor shall indemnify and hold the Employer harmless against and from all damages, losses and expenses (including legal fees and expenses) resulting from any such unnecessary or improper interference.

(iii) The Contractor shall be deemed to have been satisfied as to the suitability and availability of access routes to the Site. The Contractor shall use reasonable efforts to prevent any road or bridge from being damaged by the Contractor's traffic or by the Contractor's Personnel. These efforts shall include the proper use of appropriate vehicles and routes.

(iv) To transport the goods, unless otherwise stated:

a) the Contractor shall give the Engineer not less than 21 days' notice of

the date on which any Plant or a major item of other Goods will be delivered to the Site,

b) the Contractor shall be responsible for packing, loading, transporting, receiving unloading, storing and protecting all Goods and other things required for the Works, and

c) the Contractor shall indemnify and hold the Employer harmless against and from all damages, losses and expenses (including legal fees and expenses) resulting from the transport of Goods, and shall negotiate and pay all claims arising from their transport.

If it is found necessary for the Contractor to move one or more loads of Goods over roads, highways, bridges on which such oversized and overweight items are not normally allowed to be moved, the Contractor shall obtain prior permission from the concerned authorities. Payments for complying with the requirements, if any, for protection of or strengthening of the roads, highways or bridges shall be made by the Contractor and such expenses shall be deemed to be included in the Contract Price.

Further, the Contractor shall comply with Carriage by Road Act 2007 & Carriage by Road Rules 2011 notified on 28.02.2011 or the latest amendment. The Contractor shall use only registered common carriers for transport of goods.

(v) The Contractor shall submit along with his tender, the construction planning, phasing & sequence of construction, time & progress chart within the framework of construction schedule showing the order or procedure and a statement showing the method and techniques of construction by which the Contractor proposes to carry out the Works. Such charts or programme shall be prepared in direct relation to the time stated in the Contract for completion of part of Works. It shall indicate the commencement and completion of various trades or sections of the Works, distribution and balancing of work-load pertaining to construction activities in various structures/component parts of Works into working seasons duly taking into account working months available in each working season and number of working days available for working months, to arrive at seasonal monthly average and seasonal monthly peak progress with corresponding time periods.

The Contractor shall follow such an agreed planning & scheduling. However, Contractor shall not be relieved of any of his duties, obligations or responsibilities under the Contract.

(vi) Within one month of issue of Letter of Acceptance, the Contractor shall submit, to Engineer for his consent Master Control Network including but not limited to comprehensive bar chart stipulating quantities of work to be executed supported by machinery deployment schedule for the execution of Works within the overall time frame included in the schedule incorporated in the Contract.

(vii) During the execution of Works, if it appears to the Engineer in-charge, that actual progress of works does not conform to the programme consented by him Engineer-in-charge under GCC sub-clause 9.1(vi) above, the Contractor shall produce a revised programme dealing modifications to such programme necessary for ensuring completion of works within Time for Completion.

(viii) The Contractor shall provide a detailed month-wise cash flow estimate at the beginning of each financial year duly revised at quarterly intervals if required

so by the Engineer- in – charge.

(ix) The submission to and consent by the Engineer-in-charge of such programmes or the provision of such general descriptions or cash flow estimates shall not relieve the Contractor of any of his duties or responsibilities under the Contract.

(x) The Contractor shall design, manufacture (including associated purchases and/or subcontracting), install and complete the Facilities with due care and diligence in accordance with the Contract.

(xi) When completed, the Facilities should be fit for the purpose for which t hey are intended as defined in the Contract.

9.2 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 where the Site is located that are necessary for the performance of the Contract, including, without limitation, visas for the Contractor's and Subcontractor's personnel and entry permits for all imported Contractor's Equipment. The Contractor shall acquire all other permits, approvals and/or licenses that are not the responsibility of the Employer under GCC Sub-Clause 10 hereof and that are necessary for the performance of the Contract.

9.3 The Contractor shall comply with all laws in force in the country where the Facilities are installed and where the Installation Services are carried out. The laws will include all national, provincial, municipal or other laws that affect the performance of the Contract and bind upon the Contractor. The Contractor shall indemnify and hold harmless the Employer 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 Subcontractors and their personnel.

9.4 The Contractor shall supply and make available all raw materials, utilities, lubricants, chemicals, catalysts, other materials and facilities and shall perform all work and services of whatsoever nature required by him to properly carry out pre-commissioning, commissioning and guarantee tests.

9.5 O&M works of the Project for the period specified in Appendix-4 of Volume-5 (Forms & procedures).

10. **Employer's Responsibilities**

If requested by the Contractor, the Employer shall use its best endeavors 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 Subcontractors or the personnel of the Contractor or Subcontractors, as the case may be.

C. Payment

11. **Contract Price**

11.1 The Contract Price shall be as specified in Article 2 (Contract Price and Terms of Payment) of the Form of Contract Agreement.

11.2 The Contract price shall remain firm till completion of Contract including Operation and Maintenance for a stipulated period of 05 (Five) years from the date of commissioning in accordance with the provisions of Appendix-2 (Price Adjustment).

12. **Terms of Payment**

12.1 The Contract Price shall be paid as specified in Appendix-1 (Terms and Procedures of Payment) to the Contract Agreement. The procedures to be followed in making application for and processing payments shall be those outlined in the same Appendix-1.

12.2 No payment made by the Employer herein shall be deemed to constitute acceptance by the Employer of the Facilities or any part(s) thereof.

12.3 In the event that the Employer fails to make any payment which has become due by its respective due date or within the period set forth in the Contract, the Employer shall pay to the Contractor interest on the amount of such delayed payment at the rate(s) shown in Appendix-1 (Terms and Procedures of Payment) to the Contract Agreement for the period of delay until payment has been made in full.The due date for payment shall be within 30 days of submitting invoices by the Contractor.

12.4 The currency or currencies in which payments are made to the Contractor under this Contract shall be specified in Appendix-1 (Terms and Procedures of Payment) to the Contract Agreement, subject to the general principle that payments will be made in the currency or currencies in which the Contract Price has been stated in the Contractor's bid.

12.5 **DELAYED PAYMENTS**

All the undisputed payments for the works performed by the Contractor under the Contract shall be released as per GCC Clause 12.3.

12.6 **OVER PAYMENT AND UNDER PAYMENT:**

12.6.1 Whenever any claim whatsoever for the payment of a sum of money to the Employer arises out of or under this Contract against the Contractor, the same may be deducted by the Employer from any sum then due or which at any time thereafter may become due to the Contractor under this Contract and failing that under any other contract with the Employer or from any other sum whatsoever due to the Contractor from the Employer or from his security deposit, or he shall pay the claim on demand.

12.6.2 The Employer reserve the right to carry out post-payment audit and technical examination of the final bill including all supporting vouchers, abstracts, etc. The Employer further reserves the right to enforce recovery of any overpayment when detected, notwithstanding the fact that the amount of the final bill may be included by one of the parties as an item of

dispute before an Arbitrator appointed under GCC clause 6.2 of this Contract and notwithstanding the fact that the amount of the final bill figures in the arbitration award.

12.6.3 If as a result of such audit and technical examination any overpayment is discovered in respect of any work done by the Contractor or alleged to have been done by him under the Contract, it shall be recovered by the Employer from the Contractor by any or all of the methods prescribed above, and if any under-payment is discovered, the amount shall be duly paid to the Contractor by the Employer.

12.6.4 Provided that the aforesaid right of the Employer to adjust overpayments against amounts due to the Contractor under any other contract with the Employer shall not extend beyond the period of two years from the date of payment of the final bill or in case the final bill is a MINUS bill, from the date the amount payable by the Contractor under the MINUS final bill is communicated to the Contractor.

12.6.5 Any sum of money due and payable to the Contractor (including the security deposit returnable to him) under the Contract may be withheld or retained by way of lien by the Engineer-in-Charge or Employer against any claim of the Employer or such other person or persons in respect of payment of a sum of money arising out of or under any other contract made by the Contractor with the Engineer-in-Charge or Employer or with such other person or persons.

The sum of money so withheld or retained under this clause by the Engineer-in-Charge or Employer will be kept withheld or retained as such by the Engineer-in-Charge or Employer or till his claim arising out of in the same Contract or any other Contract is either mutually settled or determined by the Arbitrator under GCC Clause 6.2 hereof, or by the competent court.

13. Securities

13.1 Issuance of Securities

The Contractor shall provide the securities specified below in favor of the Employer at the times, and in the amount, manner and form specified below.

13.2 Advance Payment Security

The Contractor shall, provide a security of an amount in accordance with Appendix-1 (Terms and Procedures of Payment) to the Contract Agreement, and in the same currency or currencies, with a validity period in terms of Appendix -1 (Terms and Procedure of Payment) in accordance with GCC Clause 24.

The security shall be in the form provided in the Contract or in any other form acceptable to the Employer.The security in the form of a Bank Guarantee for amounts expressed in Indian Rupee shall be acceptable if the same is issued by any Indian Nationalized Bank / Scheduled Bank or a foreign Bank notified as Scheduled Bank under the provisions of "Reserve Bank of India Act" through any of its branches in India. Guarantees for amounts in currencies other than that of India, shall be

acceptable if these are issued by an international Bank of reputesituated outside India or by an authorized dealer in India as per guidelines of RBI from time to time.

The cumulative initial advance amount shall be recovered/adjusted within 14 months of date of issue of advance through Running Account Bill of Contractor as per schedule stipulated in Appendix-1 (Terms and Procedure of Payment). The security shall be returned to the Contractor as specified in Appendix-1.

The recoveries of advance payment/interest accrued thereon shall be done in accordance with Appendix-1 (Terms and Procedures of Payment).

It should be clearly understood that reduction in the value of security for advance shall not in any way dilute the Contractor's responsibility and liabilities under the Contract including in respect of the Facilities for which reduction in the value of security is allowed.

13.3 **Performance Security**

13.3.1 The contractor shall provide security for the due performance of the contractor as under:

(a) 03(Three percent) of Contract price excluding O &M Schedule [(i.e. Price Schedule No.(1+2)] in currency of the bid within twenty-eight (28) days of the notification of contract award and valid upto 90 days beyond the Defect liability period.

(b) 03(Three) percent of Contract price of O &M of Schedule (Price Schedule No. 3) in currency of the bid within twenty eight days (28) prior to end of Defect Liability period and valid upto 90days beyond Completion of O & M period. However this component of Performance Security can be subsequently reduced by the contractor on completion of each year of O&M on pro-rata basis through submission of revised Performance Security.

Further, if the sum of total prices quoted under Price Schedule 1&2 is more than 95% of the overall cost of the Project, the Employer shall withhold the amount in excess of 95% from each payment certificate pertaining to Price Schedule 1&2, on prorate basis. The total amount withheld shall be released during the O&M stage at the end of each year in equated annual instalments. No interest shall be paid by the Employer on such withheld amount. However, the employer may not withheld the excess amount if the Contractor submits unconditional bank guarantee for the amount in excess of 95% before initial payments in any of the price schedules. Such Bank Guarantee shall be valid initially upto 90 days beyond the defect liability period, which shall be extended time to time till the completion of O&M period which can be subsequently reduced by the contractor on completion of each year of O&M on pro-rata basis through submission of revised Bank Guarantee. .

If the contractor does not submit the performance security within the stipulated period due to any valid reason, Tender Inviting Authority may grant time extension for submission of performance security based on the request of contractor.

In case, the contractor does not submit performance security without a valid reason, the Employer shall impose simple interest @12% per annum on the full amount of applicable performance security (alongwith applicable taxes, if any) for the period of delay in submission of performance security. The interest on delayed period shall be calculated on pro rata basis for number of delayed days.

The interest accrued shall be payable by the Contractor within 14 days from the date of intimation by Tender Inviting Authority in form of Bank Demand Draft/ Banker Cheque in favour of 'NHPC Ltd', otherwise the same shall be recovered from any payment due or become due against bills / any other amount lying with NHPC.

The delayed submission of Performance Security by the Contractor shall be recorded in substantial completion and final completion certificates. Further, no claim for extension of time for completion period or any other type of claim on account of delayed submission of performance security shall be entertained.

If contractor fails to submit the Performance Security within 45 days (for the contracts having time for completion - upto 12 months) or 60-days (for the contracts having time for completion - more than 12 months) from the date of issue of Letter of Award (LOA), then following actions shall be taken against such Contractor:

(i) The bidder shall be debarred / banned to participate in the business dealings with NHPC for a period of one year.
ii) The name of the Contractor shall be hosted on the NHPC website etc. as per existing norms of NHPC / Govt. of India.
iii) Such defaulted contractor shall not be eligible to participate in the bidding process of re-tender of this work.

Should there arise any occasion under the Contract due to which the periods of validities of Bank Guarantees as may have been furnished by the Contractor from time to time, are required to be extended/renewed and furnish these to the Engineer one month before the expiry date of the aforesaid Guarantees originally furnished, failing which the existing Bank Guarantees shall be invoked by the Engineer. Also, in case of any deficit in Bank Guarantees on any account as might occur or is noticed, the Contractor shall forthwith recoup/replace the same at his cost with acceptable Performance Security.

13.3.2 The security shall be denominated in the currency of the Contract and shall be in the forms of bank guarantee attached hereto in the section on Forms & Procedures, or in any other form acceptable to the Employer. The security in the form of a Bank Guarantee for amounts in Indian Rupee shall be acceptable if the same is issued by any Indian Nationalized Bank/Scheduled Bank.

For online confirmation of Bank Guarantee against Performance Security, the bank details of NHPC to be communicated to the issuing Bank is as under:

Name of the beneficiary: NHPC Ltd
Account No.: 10813608692
IFSC Code: SBIN0017313
Address of the Bank: State Bank of India,
5th Floor, Red Fort Capital, Parsvanath Towers, Bhai Veer Singh Marg, Gole Market, New Delhi-110001

13.3.3 **Refund of Security Deposit:**

The Performance Security against Price Schedule No.(1+2) shall be released/ returned to the Contractor after 90 days beyond completion of Defect Liability Period. Performance Security against Price Schedule No. (3) shall be released/ returned to the Contractor after 90 days beyond completion of O&M Period.

The performance Security shall be released/ returned after adjustment/ recovery of any dues outstanding against the contractor under the contract.

13.4 Deleted.

14. **Taxes and Duties**

14.1 Except as otherwise specifically provided in the Contract, the Contractor shall bear and pay all taxes, duties, levies and charges assessed on the Contractor, its Subcontractors or their employees by all municipal, state or national government authorities in connection with the Facilities in and outside of the country where the Site is located.

14.2 HSN / SAC Code as mentioned by the Contractor in the Attachment-11 shall prevail throughout the Contract and no alteration thereof is permissible during pendency of the Contract for any reason whatsoever unless otherwise specified in any other provisions of this contract or subject to Change in Law.

GST assessed on Employer shall also be included in the prices /rates which shall be deducted from the Contractors bill and deposited to the concerned authority by the employer.

TDS wherever statutory required shall be deducted and deposited and necessary certificate will be provided by Employer.

14.3 If any tax exemptions, reductions, allowances or privileges may be available to the Contractor in the country where the Site is located, the Employer shall use its best endeavours to enable the Contractor to benefit from any such tax savings to the maximum allowable extent.

14.4 For the purpose of the Contract, it is agreed that the Contract Price specified in Article 2 (Contract Price and Terms of Payment) of the Form of Contract Agreement is based on the taxes, duties, levies and charges prevailing at the date twenty-eight (28) days prior to the date of bid submission in the country where the Site is located (hereinafter called "Tax" in this GCC Sub-Clause 14.4). If any rates of Tax are increased or decreased, a new Tax is introduced, an existing Tax is abolished, or any change in interpretation or application of any Tax occurs in the course of the performance of Contract, which was or will be assessed on the Contractor, in connection with performance of the Contract, an equitable adjustment of the Contract Price shall be made to fully take into account any such

change by addition to the Contract Price or deduction there from, as the case may be, in accordance with GCC Clause 36 (Change in Laws and Regulations) hereof.

However, these adjustments would be restricted to direct transactions between the Employer and the Contractor and not on procurement of raw materials, intermediary components etc. by the Contractor.

14.5 Further, the Contract prices shall also be after taking into account the Input Tax Credit and other benefits.

14.6 Invoices and other documents submitted by contractor for payment under Interim Payment Certificate/Final Payment Certificate, or any other payment under the contract shall be in accordance with the GST Law.

The contractor shall furnish a certificate along with Interim Payment Certificate / Final Payment certificate that GST payable by him has been deposited / will be deposited to the Government.

D. Intellectual Property Copyright

15. The copyright in all drawings, documents and other materials containing data and information furnished to the Employer by the Contractor herein shall remain vested in the Contractor or, if they are furnished to the Employer directly or through the Contractor by any third party, including suppliers of materials, the copyright in such materials shall remain vested in such third party.

The Employer shall, however, be free to reproduce all drawings, documents and other material furnished to the Employer for the purpose of the Contract including, if required, for operation and maintenance.

16. **Confidential Information**

16.1 The Employer 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 Subcontractor(s) such documents, data and other information it receives from the Employer to the extent required for the Subcontractor(s) to perform its work under the Contract, in which event the Contractor shall obtain from such Subcontractor(s) an undertaking of confidentiality similar to that imposed on the Contractor under this GCC Clause 16.

16.2 The Employer shall not use such documents, data and other information received from the Contractor for any purpose other than the operation and maintenance of the Facilities. Similarly, the Contractor shall not use such documents, data and other information received from the Employer for any purpose other than the design, procurement of Plant and Equipment, construction or such other work and services as are required for the performance of the Contract.

16.3 The obligation of a party under GCC Sub-Clauses 16.1 and 16.2 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.

16.4 The above provisions of this GCC Clause 16 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 Facilities or any part thereof.

16.5 The provisions of this GCC Clause 16 shall survive termination, for whatever reason, of the Contract.

16.6 The Contractor shall take necessary steps to ensure that all persons employed on any work in connection with this Contract have noted that the Indian Official Secret Act, 1923 (XIX of 1923) applies to them and shall continue so to apply even after the execution of such Works under the Contract.

E. Work Execution

17. **Representatives**

17.1 **Engineer In-Charge**

If the Engineer In-Charge is not named in the Contract, then within twenty-eight (28) days of the Effective Date, the Employer shall appoint and notify the Contractor in writing of the name of the Engineer In-Charge. The Employer may from time to time appoint some other person as the Engineer In-Charge 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 Employer shall take all 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 work on the Facilities. The Engineer In-Charge shall represent and act for the Employer at all times during the currency of the Contract. All notices, instructions, orders, certificates, approvals and all other communications under the Contract shall be given by the Engineer In-Charge, except as herein otherwise provided.

All notices, instructions, information and other communications given by the Contractor to the Employer under the Contract shall be given to the Engineer In-Charge, except as herein otherwise provided.

17.2 **Contractor's Representative & Construction Manager**

17.2.1 If the Contractor's Representative is not named in the Contract, then within fourteen (14) days of the Effective Date, the Contractor shall appoint the Contractor's Representative and shall request the Employer in writing to approve the person so appointed. If the Employer makes no objection to the appointment within fourteen (14) days, the Contractor's Representative shall be deemed to have been approved. If the Employer objects to the appointment within fourteen (14) days giving the reason therefor, then the Contractor shall appoint a replacement within fourteen (14) days of such objection, and the foregoing provisions of this GCC Sub-Clause 17.2.1 shall apply thereto.

17.2.2 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 Engineer In-Charge all the Contractor's notices, instructions, information and all other communications under the Contract.

All notices, instructions, information and all other communications given by the Employer or the Engineer In-Charge to the Contractor under the Contract shall be given to the Contractor's Representative or, in its absence, its deputy, except as herein otherwise provided.

The Contractor shall not revoke the appointment of the Contractor's Representative without the Employer's prior written consent, which shall not be unreasonably withheld. If the Employer consents thereto, the Contractor shall appoint some other person as the Contractor's Representative, pursuant to the procedure set out in GCC Sub-Clause 17.2.1.

17.2.3 The Contractor's Representative may, subject to the approval of the Employer (which shall not be unreasonably withheld), 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 Employer and the Engineer In-Charge.

Any act or exercise by any person of powers, functions and authorities so delegated to him or her in accordance with this GCC Sub-Clause 17.2.3 shall be deemed to be an act or exercise by the Contractor's Representative.

Notwithstanding anything stated in GCC Sub-Clause 17.1 and 17.2.1 above, for the purpose of execution of Contract, the Employer and the Contractor shall finalize and agree to a Contract Co-ordination Procedure and all the communication

under the Contract shall be in accordance with such Contract Coordination Procedure.

17.2.4 From the commencement of installation of the Facilities at the Site until operational acceptance, the Contractor's Representative shall appoint a suitable person as the construction manager (hereinafter referred to as "the Construction Manager"). The Construction Manager shall supervise all work done at the Site by the Contractor and shall be present at the Site throughout normal working hours except when on leave, sick or absent for reasons connected with the proper performance of the Contract. Whenever the Construction Manager is absent from the Site, a suitable person shall be appointed to act as his or her deputy.

17.2.5 The Employer 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 Employer, may behave inappropriately, may be incompetent or negligent, or may commit a serious breach of the Site regulations provided under GCC Sub-Clause 22.3. The Employer shall provide evidence of the same, whereupon the Contractor shall remove such person from the Facilities.

17.2.6 If any representative or person employed by the Contractor is removed in accordance with GCC Sub-Clause 17.2.5, the Contractor shall, where required, promptly appoint a replacement.

18. Work Program

18.1 Contractor's Organization

The Contractor shall supply to the Employer and the Engineer In-Charge a chart showing the proposed organization to be established by the Contractor for carrying out work on the Facilities. The chart shall include the identities of the key personnel together with the curricula vitae of such key personnel to be employed within twenty-one (21) days of the Effective Date. The Contractor shall promptly inform the Employer and the Engineer In-Charge in writing of any revision or alteration of such an organization chart.

18.2 Program of Performance

Within twenty-eight (28) days after the date of notification of award, the Contractor shall prepare and submit to the Engineer In-Charge a detailed program of performance of the Contract, made in the form of the critical path method (CPM), the PERT network, MS-Project or other internationally used programme and showing the sequence in which it proposes to design, manufacture, transport, assemble, install and pre-commission the Facilities, as well as the date by which the Contractor reasonably requires that the Employer 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, Commissioning and Acceptance of the Facilities in accordance with the Contract. The program so submitted by the Contractor shall accord with the Time Schedule included in Appendix 4 (Time Schedule) to the Contract Agreement 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 Engineer In-Charge, but without modification in the Times for Completion given and any extension granted in accordance with GCC Clause 40, and shall submit all such revisions to the Engineer In-Charge.

18.3 **Progress Report**

The Contractor shall monitor progress of all the activities specified in the program referred to in GCC Sub-Clause 18.2 (Program of Performance) above, and supply a progress report to the Engineer In-Charge every month.

The progress report shall be in a form acceptable to the Engineer In-Charge and shall 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.

18.4 **Progress of Performance**

If at any time the Contractor's actual progress falls behind the program referred to in GCC Sub-Clause 18.2 (Program of Performance), or it becomes apparent that it will so fall behind, the Contractor shall, at the request of the Employer or the Engineer In-Charge, prepare and submit to the Engineer In-Charge a revised program, taking into account the prevailing circumstances, and shall notify the Engineer In-Charge of the steps being taken to expedite progress so as to attain Completion of the Facilities within the Time for Completion under GCC Sub-Clause 8.2 (Time for Commencement and Completion), any extension thereof entitled under GCC Clause 40(Extension of Time for Completion), or any extended period as may otherwise be agreed upon between the Employer and the Contractor.

18.5 **Work Procedures**

The Contract shall be executed in accordance with the Contract Documents and the procedures given in the section on Forms and Procedures of the Contract Documents.

The Contractor may execute the Contract in accordance with its own standard project execution plans and procedures to the extent that they do not conflict with the provisions contained in the Contract.

19. **Subcontracting**

19.1 Appendix 5 (List of Approved Vendors) to the Contract Agreement specifies major items of supply or services and a list of approved vendors

against each item, including vendors. Insofar as no Vendors are listed against any such item, the Contractor shall prepare a list of vendors for such item for inclusion in such list. The Contractor may from time to time propose any addition to such a list. The Contractor shall submit any such list or any modification thereto to the Employer for its approval in sufficient time so as not to impede the progress of work on the Facilities. Such approval by the Employer for any of the vendors shall not relieve the Contractor from any of its obligations, duties or responsibilities under the Contract.

Quoted rates and prices will be deemed to apply to whichever /vendors is appointed and no adjustment of the rates and prices will be permitted.

19.2 The Contractor shall select and employ its vendors for such major items from those listed in the lists referred to in GCC Sub-Clause 19.1.

19.3 For items or parts of the Facilities not specified in Appendix 5 (List of Approved vendors) to the Contract Agreement, the Contractor may employ such /Vendors as it may select, at its discretion.

19.4 The contractors shall not be allowed to sub-contract works to any contractor from a country which shares a land border with India unless such contractor is registered with the Competent Authority. The definition of contractor from a country which shares a land border with India shall be as under.

(a) An entity incorporated, established or registered in such a country; or
(b) A subsidiary of an entity incorporated, established or registered in such a country; or
(c) An entity substantially controlled through entities incorporated, established or registered in such a country; or
(d) An entity whose beneficial owner is situated in such a country ; or
(e) An Indian (or other) agent of such an entity; or
(f) A natural person who is a citizen of such a country; or
(g) A consortium or joint venture where any member of the consortium or joint venture falls under any of the above

"Beneficial owner" for the purpose of paragraph above will be as under:

i) In case of a company of Limited Liability Partnership, the beneficial owner is the natural person(s) who whether acting alone or together or through one or more judicial person(s) has a controlling ownership interest or who exercises control through other means.

Explanation-

a) "Controlling ownership interest" means ownership of or entitlement to, more than twenty five percent of shares or capital or profits of the company";
b) "Control" shall include the right to appoint the majority of the directors or to control the management or policy decisions, including by virtue of their shareholding or management rights or shareholders agreements or voting agreements;

ii) In case of a partnership firm, the beneficial owner is the natural person(s) who, whether acting alone or together, or through one of more judicial person, has ownership of entitlement to more than fifteen

percent of capital or profits of the partnership'

iii) In case of an unincorporated association or body of individuals, the beneficial owner is the natural person(s) who whether acting alone or together, or through one or more juridical person, has ownership of or entitlement to more than fifteen percent of the property or capital or profits of such association or body of individuals;

iv) Where no natural person is identified under (i) or (ii) or (iii) above, the beneficial owner is the relevant natural person who holds the position of senior managing official;

v) In case of a trust, the identification of beneficial owner(s) shall include identification of the author of the trust, the trustee, the beneficiaries with fifteen percent or more interest in the trust and any other natural person exercising ultimate effective control over the trust through a chain of control or ownership.

"Agent" for the purpose of paragraph above is a person employed to do any act for another, or to represent another in dealings with third persons.

20. Design and Engineering

20.1 Specifications and Drawings

20.1.1 The Contractor shall execute the basic and detailed design and the engineering work in compliance with the provisions of the Contract, or where not so specified, in accordance with good engineering practice.

The Contractor shall be responsible for any discrepancies, errors or omissions in the specifications, drawings and other technical documents that it has prepared, whether such specifications, drawings and other documents have been approved by the Engineer In-Charge or not, provided that such discrepancies, errors or omissions are not because of inaccurate information furnished in writing to the Contractor by or on behalf of the Employer.

20.1.2 The Contractor shall be entitled to disclaim responsibility for any design, data, drawing, specification or other document, or any modification thereof provided or designated by or on behalf of the Employer, by giving a notice of such disclaimer to the Engineer In-Charge.

20.2 Codes and Standards

Wherever references are made in the Contract to codes and standards in accordance with which the Contract shall be executed, the edition or the revised version of such codes and standards current at the date twenty-eight (28) days prior to date of bid submission shall apply unless otherwise specified. During Contract execution, any changes in such codes and standards shall be applied after approval by the Employer without any cost adjustment / implication to either party.

20.3 Approval/Review of Technical Documents by Engineer In-Charge

20.3.1 The Contractor shall prepare and furnish to the Engineer In-Charge the documents listed in Appendix 6 (List of documents for Approval or Review) to the Contract Agreement for its approval or review as specified and as in accordance with the requirements of GCC Sub-Clause 18.2 (Program of Performance).

Any part of the Facilities covered by or related to the documents to be approved by the Engineer In-Charge shall be executed only after his approval thereof.

GCC Sub-Clauses 20.3.2 through 20.3.6 shall apply to those documents requiring the Engineer In-Charge's approval, but not to those furnished to the Engineer In-Charge for its review only.

20.3.2 Within ten (10) days after receipt by the Engineer In-Charge of any document requiring the Engineer In-Charge's approval in accordance with GCC Sub-Clause 20.3.1, the Engineer In-Charge shall either return one copy thereof to the Contractor with its approval endorsed thereon or shall notify the Contractor in writing of its disapproval thereof and the reasons therefor and the modifications that the Engineer In-Charge proposes. Should the Employer not give its approval/ comments within the said period of ten (10) days, Contractor shall serve notice on the Employer to this effect and the Employer shall give its approval/ comments within seven (7) days from receipt of such notice. In case such approval/ comment is not communicated within seven (7) days, submittals of the Contractor will be deemed to have been approved.

20.3.3 The Engineer In-Charge shall not disapprove any document, except on the grounds that the document does not comply with some specified provision of the Contract or that it is contrary to good engineering practice.

20.3.4 If the Engineer In-Charge disapproves the document, the Contractor shall modify the document and resubmit it for the Engineer In-Charge's approval in accordance with GCC Sub-Clause 20.3.2. If the Engineer In-Charge approves the document subject to modification(s), the Contractor shall make the required modification(s) and upon resubmission with the required modifications the document shall be deemed to have been approved. The procedure for submission of the documents by the Contractor and their approval by the Engineer In-Charge shall be discussed and finalized with the Contractor.

20.3.5 If any dispute or difference occurs between the Employer and the Contractor in connection with or arising out of the disapproval by the Engineer In-Charge of any document and/or any modification(s) thereto that cannot be settled between the Parties within a reasonable period in terms of GCC Clause 6.1 & 6.2, then such dispute or difference may be referred for

Arbitration/CCIE in accordance with GCC Sub-Clause 6.3/6.4 hereof. If such dispute or difference is referred for Arbitration/CCIE, the Engineer In-Charge shall give instructions as to whether and if so, how, performance of the Contract is to proceed. The Contractor shall proceed with the Contract in accordance with the Engineer In-Charge's instructions, provided that if the Arbitrator/CCIE upholds the Contractor's view on the dispute, then the Contractor shall be reimbursed by the Employer for any additional costs incurred by reason of such instructions and shall be relieved of such responsibility or liability in connection with the dispute and the execution of the instructions as the Arbitrator/CCIE shall decide, and the Time for Completion shall be extended accordingly.

20.3.6 The Engineer In-Charge'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 Engineer In-Charge.

20.3.7 The Contractor shall not depart from any approved document unless the Contractor has first submitted to the Engineer In-Charge an amended document and obtained the Engineer In-Charge's approval thereof, pursuant to the provisions of this GCC Sub-Clause 20.3.

21. Procurement

21.1 Plant and Equipment

Subject to GCC Sub-Clause 14.2, the Contractor shall manufacture or procure and transport all the Plant and Equipment in an expeditious and orderly manner to the Site.

21.2 Transportation

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

21.2.2 **Marine Transport**

The Contractor / Seller / Shippers shall arrange ocean shipment by Indian / Conference vessels through Govt. of India's forwarding agents / Coordinators. In case the forwarding agent/ Coordinators are unable to provide timely adequate space in Indian / Conference vessels, the Contractor / Sellers / shippers shall arrange shipment through any available vessel to adhere

to the delivery schedule given in the Contract.

21.2.3 Upon dispatch of each shipment of the Plant and Equipment and the Contractor's Equipment, the Contractor shall notify the Employer by facsimile or e-mail of the description of the Plant and Equipment and of the Contractor's Equipment, the point and means of dispatch, and the estimated time and point of arrival in the country where the Site is located, if applicable, and at the Site. The Contractor shall furnish the Employer with relevant shipping documents to be agreed upon between the parties.

21.2.4 The Contractor shall be responsible for obtaining, if necessary, approvals from the authorities for transportation of the Plant and Equipment and the Contractor's Equipment to the Site. The Employer 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 Employer from and against any claim for damage to roads, bridges or any other traffic facilities that may be caused by the transport of the Plant and Equipment and the Contractor's Equipment to the Site.

21.2.5 The Contractor has to comply with the provisions of carriage by Road Act 2007 Govt. of India and its rules and its further amendments (if any).

21.3 **Customs Clearance**

The Contractor shall, at its own expense, handle all imported Plant and Equipment and Contractor's Equipment at the point(s) of import and shall handle any formalities for customs clearance including liability for port charges, if any, subject to the Employer's obligations under GCC Sub-Clause 14.2, provided that if applicable laws or regulations require any application or act to be made by or in the name of the Employer, the Employer shall take all necessary steps to comply with such laws or regulations.

22. **Installation**

22.1 **Setting Out/Supervision/Labour**

22.1.1 Bench Mark: The Contractor shall be responsible for the true and proper setting-out of the Facilities.

22.1.2 Contractor's Supervision: The Contractor shall give or provide all necessary superintendence during the installation of the Facilities, and the Construction Manager or its deputy 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 work at hand.

22.1.3 Labour:

(a) The Contractor shall provide and employ on the Site in the installation of the Facilities 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.

(b) 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.

(c) The Contractor shall be responsible for obtaining all necessary permit(s) and/or visa(s) from the appropriate authorities for the entry of all labour and personnel to be employed on the Site into the country where the Site is located.

(d) The Contractor shall at its own expense provide the means of repatriation to all of its and its Subcontractor'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. In the event that the Contractor defaults in providing such means of transportation and temporary maintenance, the Employer may provide the same to such personnel and recover the cost of doing so from the Contractor.

(e) The Contractor shall at all times during the progress of the Contract use its best endeavors to prevent any unlawful, riotous or disorderly conduct or behavior by or amongst its employees and the labour of its Subcontractors.

(f) The Contractor shall, in all dealings with its labour and the labour of its Subcontractors 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.

22.2 **Contractor's Equipment**

22.2.1 All Contractor's Equipment brought by the Contractor for this Project shall be deemed to be intended to be used for the execution of the Contract. The Contractor shall not remove the same from the Site without the Engineer In-Charge's consent which shall not be unreasonably withheld, that such Contractor's Equipment is no longer required for the execution

of the Contract.

22.2.2 Unless otherwise specified in the Contract, upon completion of the Facilities, the Contractor shall remove from the Site all Equipment brought by the Contractor onto the Site and any surplus materials remaining thereon.

22.2.3 The Employer will, if requested, use its best endeavors to assist the Contractor in obtaining any local, state or national government permission required by the Contractor for the export of the Contractor's Equipment imported by the Contractor for use in the execution of the Contract that is no longer required for the execution of the Contract.

22.3 **Site Regulations and Safety**

The Employer 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 Employer, with a copy to the Engineer In-Charge, proposed Site regulations for the Employer's approval, 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 Facilities, gate control, sanitation, medical care and fire prevention.

22.4 **Emergency Work**

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 Facilities, the Contractor shall immediately carry out such work.

22.5 **Site Clearance**

22.5.1 Site Clearance in Course of Performance: In the course of carrying out the Contract, the Contractor shall keep the Site reasonably free from all unnecessary obstruction, store or remove any surplus materials, clear away any wreckage, rubbish or temporary works from the Site, and remove any Contractor's Equipment no longer required for execution of the Contract.

22.5.2 Clearance of Site after Completion: After Completion of all parts of the Facilities, the Contractor shall clear away and remove all wreckage, rubbish and debris of any kind from the Site, and shall leave the Site and Facilities clean and safe.

22.6 **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 Facilities, or for the safety of the Employers and

occupiers of adjacent property and for the safety of the public.

22.7 **Work at Night and on Holidays**

22.7.1 Unless otherwise provided in the Contract, no work shall be carried out during the night and on public holidays of the country where the Site is located without prior written consent of the Employer, except where work is necessary or required to ensure safety of the Facilities or for the protection of life, or to prevent loss or damage to property, when the Contractor shall immediately advise the Engineer In-Charge, provided that provisions of this GCC Sub-Clause 22.7.1 shall not apply to any work which is customarily carried out by rotary or double-shifts.

22.7.2 Notwithstanding GCC Sub-Clauses 22.7.1 or 22.1.3, if and when the Contractor considers it necessary to carry out work at night or on public holidays so as to meet the Time for Completion and requests the Employer's consent thereto, the Employer shall not unreasonably withhold such consent.

23. **Test and Inspection**

23.1 The Contractor shall at its own expense carry out at the place of manufacture and/or on the Site all such tests and/or inspections of the Plant and Equipment and any part of the Facilities as are specified in the Contract.

23.2 The Employer and the Engineer In-Charge or their designated representatives shall be entitled to attend the aforesaid test and/or inspection, provided that the Employer shall bear all costs and expenses incurred in connection with such attendance including, but not limited to, all travelling and board and lodging expenses.

23.3 Whenever the Contractor is ready to carry out any such test and/or inspection, the Contractor shall give a seven (7) days advance notice of such test and/or inspection and of the place and time thereof to the Engineer In-Charge. The Contractor shall obtain from any relevant third party or manufacturer any necessary permission or consent to enable the Employer and the Engineer In-Charge (or their designated representatives) to attend the test and/or inspection.

23.4 The Contractor shall provide the Engineer In-Charge with a certified report of the results of any such test and/or inspection.

If the Employer or Engineer In-Charge (or their 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 Contractor may proceed with the test and/or inspection in the absence of such persons, and may provide the Engineer In-Charge with a certified report of the results thereof.

23.5 If any Plant and Equipment or any part of the Facilities fails to pass any

test and/or inspection, the Contractor shall either rectify or replace such Plant and Equipment or part of the Facilities and shall repeat the test and/or inspection upon giving a notice under GCC Sub-Clause 23.3.

23.6 The Contractor shall afford the Employer and the Engineer In-Charge, at the Employer's expense, access at any reasonable time to any place where the Plant and Equipment are being installed, in order to inspect the progress and the manner of installation, provided that the Engineer In-Charge shall give the Contractor a reasonable prior notice.

23.7 The Contractor agrees that neither the execution of a test and/or inspection of Plant and Equipment or any part of the Facilities, nor the attendance by the Employer or the Engineer In-Charge, nor the issue of any test certificate pursuant to GCC Sub-Clause 23.4, shall release the Contractor from any other responsibilities under the Contract.

23.8 No part of the Facilities or foundations shall be covered up on the Site without the Contractor carrying out any test and/or inspection required under the Contract. The Contractor shall give a reasonable notice to the Engineer In-Charge whenever any such parts of the Facilities or foundations are ready or about to be ready for test and/or inspection; such test and/or inspection and notice thereof shall be subject to the requirements of the Contract.

23.9 The Contractor shall uncover any part of the Facilities or foundations, or shall make openings in or through the same as the Engineer In-Charge may from time to time require at the Site, and shall reinstate and make good such part or parts.

If any part of the Facilities or foundations have been covered up at the Site after compliance with the requirement of GCC Sub-Clause 23.8 and are found to be executed in accordance with the Contract, the expenses of uncovering, making openings in or through, reinstating, and making good the same shall be borne by the Employer, and the Time for Completion shall be reasonably adjusted to the extent that the Contractor has thereby been delayed or impeded in the performance of any of its obligations under the Contract.

24. Completion of the Facilities

24.1 As soon as the Facilities or any part thereof has, in the opinion of the Contractor, been completed operationally and structurally and put in a tight and clean condition as specified in the Technical Specifications, excluding minor items not materially affecting the operation or safety of the Facilities, the Contractor shall so notify the Employer in writing.

24.2 As soon as reasonably practicable the Contractor shall commence Pre-commissioning of the Facilities or the relevant part thereof in preparation for Commissioning.

24.3 As soon as all works in respect of Pre-commissioning are completed and, in the opinion of the Contractor, the Facilities or any part thereof is ready

for Commissioning, the Contractor shall commence commissioning as per procedures stipulated in "Technical Specification" and as soon as commissioning is satisfactorily completed, the Contractor shall so notify the Engineer In-Charge in writing.

24.4 The Engineer In-Charge shall, within fourteen (14) days after receipt of the Contractor's notice under GCC Sub-Clause 24.3, either issue a Completion Certificate in the form specified in the Forms and Procedures section in the Bidding Documents, stating that the Facilities or that part thereof have reached Completion as at the date of the Contractor's notice under GCC Sub-Clause 24.3, or notify the Contractor in writing of any defects and/or deficiencies.

If the Engineer In-Charge notifies the Contractor of any defects and/or deficiencies, the Contractor shall then correct such defects and/or deficiencies, and shall repeat the procedure described in GCC Sub-Clause 24.3.

If the Engineer In-Charge is satisfied that the Facilities or that part thereof have reached Completion, the Engineer In-Charge shall, within seven (7) days after receipt of the Contractor's repeated notice, issue a Completion Certificate stating that the Facilities or that part thereof have reached Completion as at the date of the Contractor's repeated notice.

If the Engineer In-Charge is not so satisfied, then it shall notify the Contractor in writing of any defects and/or deficiencies within seven (7) days after receipt of the Contractor's repeated notice, and the above procedure shall be repeated.

24.5 If the Engineer In-Charge fails to issue the Completion Certificate and fails to inform the Contractor of any defects and/or deficiencies within fourteen (14) days after receipt of the Contractor's notice under GCC Sub-Clause 24.3 or within seven (7) days after receipt of the Contractor's repeated notice under GCC Sub-Clause 24.4, or if the Employer makes use of the Facilities or part thereof, then the Facilities or that part thereof shall be deemed to have reached Completion as of the date of the Contractor's notice or repeated notice, or as of the Employer's use of the Facilities, as the case may be.

24.6 As soon as possible after Completion, the Contractor shall complete all outstanding minor items so that the Facilities are fully in accordance with the requirements of the Contract, failing which the Employer will undertake such completion and deduct the costs thereof from any moneys owing to the Contractor.

24.7 Upon Completion and handing over of the facilities or the relevant part thereof by the Contractor to the Employer, the Employer shall be responsible for the care and custody of the Facilities or the relevant part thereof subject to the obligations of the contractor as spelt out for the O&M and Defect Liability Period under the contract.

25. **Commissioning and Operational Acceptance**

25.1 **Commissioning**

Commissioning of the Facilities or any part thereof shall be completed by the Contractor as per procedures detailed in Technical Specifications.

All raw materials, utilities, lubricants, chemicals, catalysts, facilities, services and other matters required for Commissioning shall be provided by the Contractor, unless otherwise specified in the Technical Specifications.

25.2 **Guarantee Test**

25.2.1 The Guarantee Test (and repeats thereof) shall be conducted by the Contractor after Commissioning of the Facilities or the relevant part thereof to ascertain whether the Facilities or the relevant part can attain the Functional Guarantees specified in the Contract documents. The Contractor's and Engineer In-Charge's advisory personnel shall attend the Guarantee Test. The Employer shall promptly provide the Contractor with such information as the Contractor may reasonably require in relation to the conduct and results of the Guarantee Test (and any repeats thereof).

25.2.2 If for reasons not attributable to the Contractor, the Guarantee Test of the Facilities or the relevant part thereof cannot be successfully completed within the period agreed upon by the Employer and the Contractor, the same may be reviewed and a new time period may be fixed as agreed by the Employer and the Contractor for conducting such Guarantee Test.

25.3 **Operational Acceptance**

25.3.1 Subject to GCC Sub-Clause 25.4 (Partial Acceptance) below, Operational Acceptance shall occur in respect of the Facilities or any part thereof when

(a) the Guarantee Test has been successfully completed and the Functional Guarantees are met ; or

(b) Deleted

(c) the Contractor has paid the liquidated damages specified in GCC Sub-Clause 28.3 hereof; and

(d) any minor items mentioned in GCC Sub-Clause 24.6 hereof relevant to the Facilities or that part thereof have been completed.

25.3.2 At any time after any of the events set out in GCC Sub-Clause 25.3.1 have occurred, the Contractor may give a notice to the Engineer In-Charge requesting the issue of an Operational Acceptance Certificate in the form provided in the Bidding Documents or in another form acceptable to the Employer in respect of the Facilities or the part thereof specified in such notice as at the date of such notice.

25.3.3 The Engineer In-Charge shall, after consultation with the Employer, and within twenty-one (21) days after receipt of the Contractor's notice, issue an Operational Acceptance Certificate.

25.3.4 If within twenty-one (21) days after receipt of the Contractor's notice, the Engineer In-Charge fails to issue the Operational Acceptance Certificate or fails to inform the Contractor in writing of the justifiable reasons why the Engineer In-Charge has not issued the Operational Acceptance Certificate, the Facilities or the relevant part thereof shall be deemed to have been accepted as at the date of the Contractor's said notice.

25.4 **Partial Acceptance**

25.4.1 If the Contract specifies that Completion and Commissioning shall be carried out in respect of parts of the Facilities, the provisions relating to Completion and Commissioning including the Guarantee Test shall apply to each such part of the Facilities individually, and the Operational Acceptance Certificate shall be issued accordingly for each such part of the Facilities.

25.4.2 If a part of the Facilities comprises facilities such as buildings, for which no Commissioning or Guarantee Test is required, then the Engineer In-Charge shall issue the Operational Acceptance Certificate for such facility when it attains Completion, provided that the Contractor shall thereafter complete any outstanding minor items that are listed in the Operational Acceptance Certificate.

F. Guarantees and Liabilities

26. **Completion Time Guarantee**

26.1 The Contractor guarantees that it shall attain Completion of the Facilities (or a part for which a separate time for completion is specified in the Contract) within the Time for Completion specified in the Contract pursuant to GCC Sub-Clause 8.2, or within such extended time to which the Contractor shall be entitled under GCC Clause 40 (Extension of Time for Completion) hereof.

26.2 If the Contractor fails to attain Completion of the Facilities or any part thereof within the Time for Completion or any extension thereof under GCC Clause 40 (Extension of Time for Completion), the Contractor shall pay to the Employer liquidated damages in the amount computed **@INR 17726/- per day per MW(AC)** of Solar Plant not connected with the grid. Fraction of MW shall be prorated. Decision to impose Liquidated damages shall be notified to the contractor as and when the default/breach is established and quarterly thereafter. Recovery/appropriation of LD thereof will be made on the basis of date of issue of taking over certificate, reckoning the days of delays elapsed

between the relevant time of completion and the date stated in taking over certificate.

The aggregate amount of such liquidated damages shall in no event exceed the ten (10%) of the total Contract price i.e., sum of Schedule-1,Schedule-2, & Schedule-3.

Once the "Maximum amount equivalent to 10% of Total Contract Price" is reached, the Employer may consider termination of the Contract, pursuant to GCC Sub-Clause 42.2.2. Such payment shall completely satisfy the Contractor's obligation to attain Completion of the Facilities or the relevant part thereof within the Time for Completion or any extension thereof under GCC Clause 40 (Extension of Time for Completion). The Contractor shall have no further liability whatsoever to the Employer in respect thereof.

However, the payment of liquidated damages shall not in any way relieve the Contractor from any of its obligations to complete the Facilities or from any other obligations and liabilities of the Contractor under the Contract.

Save for liquidated damages payable under this GCC Sub-Clause 26.2, the failure by the Contractor to attain any milestone or other act, matter or thing by any date specified in **Appendix 4** (Time Schedule) to the Contract Agreement and/or other program of work prepared pursuant to GCC Clause 18 (Program of Performance) shall not render the Contractor liable for any loss or damage thereby suffered by the Employer.

26.3 No bonus will be given for earlier completion of the Facilities or part thereof.

26.4 LD not recovered under GCC Clause 26.2, if any, shall be recovered from RA bills or Performance Security Deposit or from any other sum payable to the contractor.

27. Defects Liability

27.1 The Contractor warrants that the Facilities or any part thereof shall be free from defects in the design, engineering, materials and workmanship of the Plant and Equipment supplied and of the work executed.

27.2 The Defects Liability Period shall be Twenty Four (24) months from the date of completion of the facilities (or any part thereof) or Eighteen (18) months from the date of Operational Acceptance of the facilities (or any part thereof) whichever first occurs, unless, specified otherwise in the SCC for Solar PV Power Projects.

If the warranty provided by the manufacturer for the equipments installed is more than the period of defect liability specified in the contract, the defect liability of such equipments shall be applicable as per manufacturer's standards.

If during the Defects Liability Period any defect is found in the design, engineering, materials and workmanship of the Plant and Equipment supplied or of the work executed by the Contractor, the Contractor shall promptly, in consultation and agreement with the Employer 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 Facilities caused by such defect.

27.3 The Employer 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 Employer shall afford all reasonable opportunity for the Contractor to inspect any such defect.

27.4 The Employer shall afford the Contractor all necessary access to the Facilities and the Site to enable the Contractor to perform its obligations under this GCC Clause 27. The Contractor may, with the consent of the Employer, remove from the Site any Plant and Equipment or any part of the Facilities that are defective if the nature of the defect, and/or any damage to the Facilities caused by the defect, is such that repairs cannot be expeditiously carried out at the Site.

27.5 If the repair, replacement or making good is of such a character that it may affect the efficiency of the Facilities or any part thereof, the Employer may give to the Contractor a notice requiring that tests of the defective part of the Facilities 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 Facilities passes such tests. The tests in Character shall in any case be not less than what has already been agreed by the Employer and the Contractor for the original equipment / part of the Facilities.

27.6 If the Contractor fails to commence the work necessary to remedy such defect or any damage to the Facilities caused by such defect within a reasonable time (which shall in no event be considered to be more than fifteen (15) days), the Employer may, following notice to the Contractor, proceed to do such work, and the reasonable costs incurred by the Employer in connection therewith shall be paid to the Employer by the Contractor or may be deducted by the Employer from any moneys due the Contractor or claimed under the Performance Security.

27.7 Upon correction of the defects in the Facilities or any part thereof by repair / replacement, such repair/replacement shall have the Defects Liability Period extended by such period as defined under clause 27.2 above from the time such replacement / repair of the Facilities or any part thereof subject to maximum period as stated in Defect Liability Period clause 27.2.

At the end of the Defects Liability Period, the Contractor's liability ceases except for latent defects. The Contractor's liability for latent defects warranty shall be till completion of O&M period from the date of

commissioning including Defects Liability Period.

27.8 Except as provided in GCC Clauses 27 and 33 (Loss of or Damage to Property / Accident or Injury to Workers/ Indemnification), 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 Facilities or any part thereof, the Plant and Equipment, design or engineering or work executed that appear after Completion of the Facilities or any part thereof, except where such defects are the result of the gross negligence, fraud, criminal or willful action of the Contractor.

28. **Functional Guarantees**

28.1 The Contractor guarantees that during the Guarantee Test, the Facilities and all parts thereof shall attain the Functional Guarantees specified in Appendix 7 (Functional Guarantees) to the Contract Agreement, subject to and upon the conditions therein specified.

28.2 Deleted

28.3 If, for reasons attributable to the Contractor, the Functional Guarantees specified in Appendix 7(Functional Guarantees) to the Contract Agreement are not attained either in whole or in part, , the Contractor shall, at the Employer's option, either.

(a) make such changes, modifications and/or additions to the Facilities or any part thereof that are necessary to attain the Functional Guarantees at its cost and expense within a mutually agreed time, and shall request the Employer to repeat the Guarantee Test or

(b) pay liquidated damages to the Employer within 45 days of notification of the same by the Engineer-in-Charge in respect of the failure to meet the Functional Guarantees in accordance with the provisions in Appendix 7(Functional Guarantees) to the Contract Agreement. In case of any delay in payment by the Contractor, interest as provided in Sl. No. 3 of Appendix-1 (Terms and Procedures of payment) shall be charged.

28.4 In case the Employer exercises its option to accept the equipment after levy of liquidated damages, the payment of liquidated damages under GCC Sub-Clause 28.3 (b) and upon the payment of such liquidated damages by the Contractor, the Engineer-In-Charge shall issue the Operational Acceptance Certificate for the Facilities or any part thereof in respect of which the liquidated damages have been so paid.

28.5 In case of shortfall in generation (as per clause 1.11 of Chapter 1: General Technical Requirement of PTS-E&M Works), the Contractor shall compensate the Employer @ **Rs. 29/unit** of the shortfall limited to fifteen (15) % of Total EPC Contract Price (i.e. sum of prices of all individual price schedules). Additional GST on such compensation amount if applicable shall be borne by contractor.

28.6 **Guarantee Generation during O & M period** :

The O&M Period is defined in 'GCC Clause 1.1: Definitions' and 'GCC Clause 3.6.1: Construction of Contract' of the tender document.

The Solar PV Power Plant shall be designed such that the Net Exported Energy from the Plant is not less than the Minimum Guaranteed Generation (MGG) for that year considering the Module Correction Factor (MCF) for performance degradation of modules. The computation for shortfall in Net Exported Energy during O&M Period shall be calculated as per Appendix-7. The shortfall in Net Exported Energy shall be compensated by the EPC Contractor to NHPC as below:

Compensation for shortfall in Generation during O&M Period for the project	=	Shortfall in Generation as calculated in Appendix-7 x Prevailing PPA Tariff in Rs./kWh

The total compensation under this sub-clause on account of shortfall in generation during each year O&M period shall be limited to generation revenue corresponding to 10 % of the quoted generation by the bidder at prevailing tariff in Rs/Kwh. Recovery of such compensation shall be first deducted from payment towards O&M contract value upto limiting level of 25% of the Annual Contract Value. In case the LD recovery amount exceeds above limiting value, balance amount shall be recovered through Performance Bank Guarantee submitted by EPC Contractor towards O&M period. The value of amount encashed from above BG shall have to be replenished by EPC contractor within three months. Additional GST on such compensation amount shall be borne by contractor.

28.7 **Security for Shortfall in generation during O&M Period**

Bidder shall furnish a security in form of Bank Guarantee to take care of Shortfall in generation during O&M Period, AMC of the Equipment & other specified elsewhere in the Contract during O&M and AMC period per in terms of SCC Clause No 10.

29. **Patent Indemnity**

29.1 The Contractor shall, subject to the Employer's compliance with GCC Sub-Clause 29.2, indemnify and hold harmless the Employer and 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 Employer 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

Facilities by the Contractor or the use of the Facilities in the country where the Site is located; and (b) the sale of the products produced by the Facilities in any country.

Such indemnity shall not cover any use of the Facilities 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 Facilities or any part thereof, or any products produced thereby in association or combination with any other equipment, plant or materials not supplied by the Contractor, pursuant to the Contract Agreement.

29.2 If any proceedings are brought or any claim is made against the Employer arising out of the matters referred to in GCC Sub-Clause 29.1, the Employer shall promptly give the Contractor a notice thereof, and the Contractor may at its own expense and in the Employer'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 Employer within twenty-eight (28) days after receipt of such notice that it intends to conduct any such proceedings or claim, then the Employer shall be free to conduct the same on its own behalf. Unless the Contractor has so failed to notify the Employer within the twenty-eight (28) day period, the Employer shall make no admission that may be prejudicial to the defense of any such proceedings or claim.

The Employer 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.

29.3 The Employer shall indemnify and hold harmless the Contractor and its employees, officers and Subcontractors 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 Contractor 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 arising out of or in connection with any design, data, drawing, specification, or other documents or materials provided or designed by or on behalf of the Employer.

30. Limitation of Liability

Except in cases of criminal negligence or willful misconduct,

(a) Neither party shall be liable to the other Party, whether in contract, tort, or otherwise, for any indirect or consequential loss or damage, loss of use, loss of production, or loss of profits or interest costs, which may be suffered by the other Party in connection with the Contract, other than specifically provided as any obligation of the Party in the Contract.

(b) the aggregate liability of the Contractor to the Employer, whether under the Contract, in tort or otherwise, shall not exceed the Contract Price for EPC Works, provided that this limitation shall not apply to the cost of repairing or replacing defective equipment, or to any obligation of the Contractor to indemnify the Employer with respect to patent infringement.

(c) Similarly the aggregate liability of the Contractor to the Employer, whether under the Contract, in tort or otherwise, shall not exceed the annual contract price of each year for O&M Contract, provided that this limitation shall not apply to the cost of repairing or replacing defective equipment, or to any obligation of the Contractor to indemnify the Employer with respect to patent infringement.

G. Risk Distribution

31. Transfer of Ownership

31.1 Ownership of the Plant and Equipment (including spare parts) to be imported into the country where the Site is located shall be transferred to the Employer upon loading on to the mode of transport to be used to convey the Plant and Equipment from the country of origin to that country and upon endorsement of the dispatch documents in favour of the Employer. For this purpose High Sea Sale agreement as per Form 7C to the Contract agreement shall be signed.

31.2 Ownership of the Plant and Equipment (including spare parts) procured in the country where the Site is located shall be transferred to the Employer when the Plant and Equipment are loaded on to the mode of transport to be used to convey the plant and equipment from the works to the site and upon endorsement of dispatch documents in favor of the Employer

31.3 Ownership of the Contractor's Equipment used by the Contractor and its Subcontractors in connection with the Contract shall remain with the Contractor or its Subcontractors.

31.4 Ownership of any Plant and Equipment in excess of the requirements for the Facilities shall revert to the Contractor upon Completion of the Facilities or at such earlier time when the Employer and the Contractor agree that the Plant and Equipment in question are no longer required for the Facilities provided quantity of any plant or equipment specifically stipulated in the Contract shall be the property of the Employer whether or not incorporated in the Facilities.

31.5 Notwithstanding the transfer of ownership of the Plant and Equipment, the responsibility for care and custody thereof together with the risk of loss or damage thereto shall remain with the Contractor pursuant to GCC Clause 32 (Care of Facilities) hereof until Completion of the Facilities or the part thereof in which such Plant and Equipment are incorporated.

32. **Care of Facilities**

32.1 The Contractor shall be responsible for the care and custody of the Facilities or any part thereof until the date of Completion of the Facilities pursuant to GCC Clause 24 (Completion of the Facilities) or, where the Contract provides for Completion of the Facilities in parts, until the date of Completion of the relevant part, and shall make good at its own cost any loss or damage that may occur to the Facilities or the relevant part thereof from any cause whatsoever during such period. The Contractor shall also be responsible for any loss or damage to the Facilities caused by the Contractor or its Subcontractors in the course of any work carried out, pursuant to GCC Clause 27 (Defects Liability). Notwithstanding the foregoing, the Contractor shall not be liable for any loss or damage to the Facilities or that part thereof caused by reason specified or referred to in GCC Sub-Clauses 38.

32.2 The Contractor shall be liable for any loss of or damage to any Contractor's Equipment, or any other property of the Contractor used or intended to be used for purposes of the Facilities.

33 **Loss of or Damage to Property, Accident or Injury to Workers; Indemnification**

33.1 Subject to GCC Sub-Clause 33.3, the Contractor shall indemnify and hold harmless the Employer and 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, in respect of the death or injury of any person or loss of or damage to any property (other than the Facilities whether accepted or not), arising in connection with the supply and installation of the Facilities and by reason of the negligence of the Contractor or its Subcontractors, or their employees, officers or agents, except any injury, death or property damage caused by the negligence of the Employer, its contractors, employees, officers or agents.

33.2 If any proceedings are brought or any claim is made against the Employer that might subject the Contractor to liability under GCC Sub-Clause 33.1, the Employer shall promptly give the Contractor a notice thereof and the Contractor may at its own expense and in the Employer'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 Employer within twenty-eight (28) days after receipt of such notice that it intends to conduct any such proceedings or claim, then the Employer shall be free to conduct the same on its own behalf. Unless the Contractor has so failed to notify the Employer within the twenty-eight (28) day period, the Employer shall make no admission that may be prejudicial to the defence of any such proceedings or claim.

The Employer 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.

33.3 The Employer shall indemnify and hold harmless the Contractor and its employees, officers and Subcontractors from any liability for loss of or damage to property of the Employer, other than the Facilities not yet taken over, that is caused by fire, explosion or any other perils, in excess of the amount recoverable from insurances procured under GCC Clause 34 (Insurances), provided that such fire, explosion or other perils were not caused by any act or failure of the Contractor.

33.4 The party entitled to the benefit of an indemnity under this GCC Clause 33 shall take all reasonable measures to mitigate any loss or damage which has occurred. If the party fails to take such measures, the other party's liabilities shall be correspondingly reduced.

34. **Insurance**

34.1 To the extent specified in Appendix 3 (Insurance Requirements) to the Contract Agreement, the Contractor shall at its expense take out and maintain in effect, or cause to be taken out and maintained in effect, during the performance of the Contract, the insurances set forth below in the sums and with the deductibles and other conditions specified in the said Appendix. The identity of the insurers and the form of the policies shall be subject to the approval of the Employer, who should not unreasonably withhold such approval.

(a) Cargo Insurance

Covering loss or damage occurring while in transit from the Contractor's or Subcontractor's works or stores until arrival at the Site including unloading, to the Plant and Equipment (including spare parts therefor) and to the Contractor's Equipment. This policy shall cover 'ALL RISKS' under and /or on deck as per Institute Cargo Clause 'A'.

(b) Erection All Risks Insurance

Covering physical loss or damage to the Facilities at the Site, occurring prior to Completion of the Facilities, with extended maintenance coverage for the Contractor's liability in respect of any loss or damage occurring during the Defects Liability Period while the Contractor is on the Site for the purpose of performing its obligations during the Defects Liability Period. The policy shall be extended to Work Stoppages clause and Intermittent testing clause.

(c) Workmen's Compensation Insurance

Covering legal liability coverage for compensation to employees for bodily injury or death caused due to accidents / occupational diseases arising out of and in course of employment in accordance with the statutory requirements applicable in the region where the facilities or any part thereof is executed.

(d) Third Party Liability Insurance

Covering bodily injury or death suffered by third parties (excluding the Employer's personnel) and loss of or damage to property

occurring in connection with the supply and installation of the Facilities.

(e) Employer's Liability

In accordance with the Public Insurance Act applicable in India.

34.2 The Employer shall be named as co-insured under all insurance policies taken out by the Contractor pursuant to GCC Sub-Clause 34.1, except for the Third Party Liability, Employer's Liability& Workmencompensation Insurances and the Contractor's Subcontractors shall be named as co-insured under all insurance policies taken out by the Contractor pursuant to GCC Sub-Clause 34.1 except for the Cargo Insurance during Transport, Workers' Compensation and Employer's Liability Insurances. All insurer's rights of subrogation against such co-insured for losses or claims arising out of the performance of the Contract shall be waived under such policies.

In case the Contractor has taken / takes blanket insurance policies for "Marine policy" during transportation of material and "Erection All Risk policy" during storage and erection, such polices shall also be acceptable to Employer provided that;

(i) The name of the Employer and the Project is endorsed in the said policies, and

(ii) A clause be incorporated in the said policy that prior to settlement of any claim by the insurer against these policies, 'No objection certificate' shall be obtained from the Employer.

34.3 The Contractor shall, in accordance with the provisions of Appendix 3 (Insurance Requirements) to the Contract Agreement, deliver to the Employer certificates of insurance (or copies of the insurance policies) as evidence that the required policies are in full force and effect. The certificates shall provide that no less than twenty-one (21) days' notice shall be given to the Employer by insurers prior to cancellation or material modification of a policy.

34.4 The Contractor shall ensure that, where applicable, its Subcontractor(s) shall take out and maintain in effect adequate insurance policies for their personnel and vehicles and for work executed by them under the Contract, unless such Subcontractors are covered by the policies taken out by the Contractor.

34.5 If the Contractor fails to take out and/or maintain in effect the insurances referred to in GCC Sub-Clause 34.1, the Employer may effect recovery of such premium on pro-rata basis from progress payments of the Contractor. Additionally progress payments may also be suspended until Contractor complies with requirements of this clause.

34.6 Unless otherwise provided in the Contract, the Contractor shall prepare and conduct all and any claims made under the policies effected by it pursuant to this GCC Clause 34, and the moneys payable by any insurers shall be paid to the Contractor. The Employer shall give to the Contractor all such reasonable assistance. With respect to insurance

claims in which the Employer's interest is involved, the Contractor shall not give any release or make any compromise with the insurer without the prior written consent of the Employer.

34.7 **Insurance coverage during Operation & maintenance Period**

The Employer shall take Insurance cover at its own cost during the Operation & Maintenance Period :

The responsibility of Machinery Break Down (MBD)/Electronic equipment shall be of the Contractor during the entire O&M period including Defect Liability Period.

34.7.1 **Scope of Cover**

The Insurance Cover to be obtained by the Employer during O&M period shall cover property insured & generation loss, if accidentally physically lost/destroyed or damaged by the perils covered under the Insurance Policy taken by the Employer. The coverage will be on an All risk basis as per Munich Re wordings, for liability, namely:

i. Fire and allied perils like Fire; lightening; Explosion/implosion; Aircraft damage; Riot, Strike, Malicious damage (RSMD); Storm, Cyclone Typhoon, Tempest Hurricane, Tornado, Flood & inundation (STFI), Impact damage, Subsidence & landslide including rockslide, Bursting & Overflowing of water tanks, Apparatus & pipes, Missile testing operation, leakage from automatic sprinkler installations, & Bush fire, Burglary/Theft.
ii. Earthquake (Fire and Shock)
iii. Generation Loss (FLOP).
iv. Terrorism (Fire + FLOP) including Electronic Equipment breakdown.
v. third party Liability (General Liability) but not limited to above perils.

The cost towards reinstatement of the damaged equipment / component due to above risks of Fire & Allied Perils & / or Force Majeure events covered under the insurance policy taken by Employer post commissioning of WTGs shall be to the Employer's account. A separate work order shall be issued by Employer to the O&M contractor at mutually agreed terms for reinstatement, which shall have no linkage with the scope of O&M contract.

35. LABOUR LAWS

35.1 The Contractor shall employ labour in sufficient numbers to maintain the required rate of progress and quality to ensure workmanship of the degree specified in the Contract. The Contractor shall not employ in connection with the works any person who has not completed fifteen years of age. The Contractor is encouraged, to the extent practicable and reasonable, to

employ staff and labour with appropriate qualifications and experience from the region of the project. Unskilled labour shall be recruited from local region only.

35.2 The Contractor shall furnish and deliver fortnightly to the Engineer-in-Charge, a distribution return of the number and description by trades of the works of people employed on the works. The contractor shall also submit on the 4th and 19th of every month to the Engineer-in- charge a true statement showing in respect of the second half of the preceding month and the first half of the current month.

i) The accidents that occurred during the said fortnight showing the circumstances under which they happened and the extent of damage and injury caused by them, and

ii) The number of female workers who have been allowed maternity benefit as provided in the Maternity Benefit Act, 1961 or Rules made thereunder.

35.3 The Contractor shall ensure to obtain the EPF code number from the concerned authorities before start of Works and will not engage any sub-contractor who does not possess EPF code number. All the workers deployed by contractors or sub-contractors should be members of Provident Fund and should be given the Universal Account Number (UAN).

35.4 During continuance of the Contract, the Contractor and his sub-contractor(s) shall abide at all times by all existing labour enactments and rules made thereunder, regulations, notifications and bye laws of State or Central Government or local authority and any other labour law (including rules), regulations, bye laws that may be passed or notification that may be issued under any labour law in future either by the State or the Central Government or the local authority. The Contractor shall also comply with the Laws relating to their employment, health, safety, welfare, immigration, and shall allow them all their legal rights. The Contractor shall keep the Employer indemnified in case any action is taken against the Employer by the competent authority on account of contravention by the Contractor of any of the provisions of any Act or rules made thereunder, regulations or notifications including amendments. If the Employer is caused to pay or reimburse, such amounts 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 Employer 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 Employer.

The employees of the Contractor and his sub-contractor in no case shall be treated as the employees of the Employer at any point of time.

Salient features of some of the major labour laws that are applicable to construction industry including amendments (if any) thereto are given below.

(i) Employee Compensation Act 1923 as amended.

The Act provides for compensation in case of injury or death by accident arising out of and during the course of employment.

(ii) Payment of Gratuity Act 1972

Gratuity is payable to an employee under the Act on satisfaction of certain conditions on separation if an employee has completed 5 years of service or more or on death or on retirement or superannuation at the rate of 15 days wages for every completed year of service. The Act is applicable to all establishments employing 10 or more employees.

(iii) Employees PF and Miscellaneous Provision Act 1952 including FPS-71/EPS-95.

The Contractor is required to possess PF Code from the concerned Regional Provident Fund Commission. The benefits payable under the Act are:

(a) Pension or family pension on retirement or death as the case may be.

(b) Deposit linked insurance on the death in harness of the worker.

(c) Payment of PF accumulation on retirement/death etc.

(iv) Maternity Benefit Act 1961 (Amended)

The Act provides for leave and some other benefits to women employees.

(v) Contract Labour (Regulation and Abolition) Act 1970 with Rules framed there under as amended.

The Act provides for certain welfare measures and wages to be provided by the Contractor to contract labour and in case the Contractor fails to provide, the same are required to be provided by the principal employer (the Employer) and recover the same from the Contractor from any amount / monies due to him. The principal Employer (the Employer) is required to take Certificate of Registration and the Contractor is required to take a License from the designated officer. The Act is applicable to the establishments or Contractor or principal employer (the Employer) if they employ 20 or more contract labour.

(vi) Minimum Wages Act 1948 (Amended)

The Contractor is to pay not less than the Rate of Minimum Wages notified by the appropriate Government as per provisions of the Act.

(vii) Payment of Wages Act 1936 (Amended)

It lays down as to by what date the wages are to be paid, when it will be paid and what deductions can be made from the wages of the workers.

(viii) Equal Remuneration Act 1979

The Act provides for payment of equal wages for work of equal nature to Male and Female workers and not making discrimination against Female employees in the matters of transfers, training and promotions etc.

(ix) Payment of Bonus Act 1965 and any amendments thereof.

The Act is applicable to all establishments employing 20 or more workmen. The Act provides for payments of annual bonus subject to a minimum of 8.33 % of wages and maximum of 20 % of wages to employees drawing Rs. 21,000/- P.M. or less. The bonus to be paid to employees getting Rs. 7,000/- PM or above upto Rs. 21,000/- PM shall be worked out by taking wages as Rs .7,000/- p.m. or the minimum wages for the scheduled employments as fixed by the appropriate Govt. whichever is higher. All amounts of Bonus are required to be paid within eight months of closing of financial year. The newly set up establishments are exempted for five years in certain circumstances.

(x) Industrial Disputes Act 1947 (Amended)

The Act lays down the machinery and procedure for resolution of industrial disputes, in what situations a strike or lock-out becomes illegal and what are the requirements for laying off or retrenching the employees or closing down the establishment.

(xi) Industrial Employment (Standing Orders) Act 1946 (Amended)

It is applicable to all establishments employing 100 or more workmen (employment size reduced by some of the States and Central Government to 50). The Act provides for laying down rules governing the conditions of employment by the Employer on matters provided in the Act and get the same certified by the designated Authority.

(xii) Trade Unions Act 1926

The Act lays down the procedure for registration of trade unions of workmen and employers. The trade unions registered under the Act have been given certain immunities from civil and criminal liabilities.

(xiii) Child Labour (Prohibition and Regulation) Act 1986

The Act prohibits employment of children below 14 years of age in certain occupations and processes and provides for regulation of employment of children in all other occupations and processes. Employment of child labour is prohibited in Building and Construction Industry.

(xiv) Inter-State Migrant Workmen's (Regulation of Employment and Conditions of Service) Act 1979

The Act is applicable to an establishment which employs 5 or more inter-state migrant workmen through an intermediary (who has recruited workmen in one state for employment in the establishment situated in another state). The inter-state migrant workmen, in an establishment to which this Act becomes applicable, are required to be provided certain facilities such as housing, medical aid, travelling expenses from home up to the establishment and back, etc.

(xv) The Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act 1996 and the Cess Act of 1996

All the establishments who carry on any building or other construction work and employ 10 or more workers are covered under this Act. All such establishments are required to pay cess at rate of 1% of the cost of construction as may be notified by the Government. The employer (the Contractor) to whom the Act applies has to obtain a registration certificate from the Registering Officer appointed by the Government.

(xvi)The Factories Act 1948

The Act lays down the procedure for approval of plans before setting up a factory, health and safety provisions, welfare provisions, working hours, annual earned leave and rendering information regarding accidents or dangerous occurrences to designated authorities. It is applicable to premises employing 10 persons or more with aid of power or 20 or more persons without the aid of power engaged in manufacturing process.

(xvii) The Personal Injuries (Compensation Insurance) Act, 1963 and any modifications thereof and rules made there under from time to time.

(xviii)Employees State Insurance Act, 1948

The Act provides for certain benefits to employees in case of sickness,Maternity and Employment injury and for certain other matter in relation thereto.

The compliance of all the labour laws acts shall be along with latest amendments (if any) of the respective Act.

The Contractor shall require his employees to obey all applicable Laws, including those concerning safety at work.

The definition of "Principal Employer for this clause shall be as per Contract Labour (Regulation and Abolition) Act 1970.

35.5 The Engineer-in-Charge shall on a report having been made by an authorized Inspecting Officer as defined in the Contract Labour (Regulation and Abolition) Act and Rules or on his own in his capacity as Principal Employer, have the power to deduct from the amount due to the Contractor any sum required or estimated to be required for making good the loss suffered by

worker(s) by reasons of non fulfillment of the conditions of the Contract for the benefit of workers, non-payment of wages or of deductions made by him from wages which are not justified by the terms of the contract or non-observance of the relevant Acts and Rules with amendments made from time to time. If the Employer makes payment to Contractor's labour due to non-payment of wages to labour by the Contractor, the Employer shall recover the amount thus paid from the next running account bill of the Contractor.

35.6 The Contractor shall indemnify the Employer against any payments to be made under and for observance of the Regulations, Laws, Rules as stipulated in GCC sub-clause 35.4 above without prejudice to his right to claim indemnity from his sub-contractors. In the event of the Contractor's failure to comply with the provisions of GCC sub-clause 35.4 or in the event of decree or award or order against the Contractor having been received from the competent authority on account of any default or breach or in connection with any of the provisions of GCC sub-clause 35.4 above, the Engineer-in-Charge, without prejudice to any other right or remedy under the Contract, shall be empowered to deduct such sum or sums from the running account bills of the Contractor or from his Security Deposit or from other payments due under this contract or any other Contract to satisfy within a reasonable time the provisions of the various Acts/Laws/Rules/Codes as mentioned under GCC sub-clause 35.4 above, on the part of the Contractor under the Contract on behalf of and at the expenses of the Contractor and make payment and/or provide amenities/facilities/services accordingly. In this regard, the decision of the Engineer-in-Charge shall be conclusive and binding on the contractor.

35.7 The Contractor shall at his own expense comply with or cause to be complied with the Provisions/Rules provided for welfare and health of Contract Labour in the Contract Labour (Regulation & Abolition) Act and other relevant Acts and Rules framed there under or any other instructions issued by the Employer in this regard for the protection of health and for making sanitary arrangements for workers employed directly or indirectly on the works. In case, the Contractor fails to make arrangements as aforesaid, the Engineer-in-Charge shall be entitled to do so and recover the cost thereof from the Contractor.

35.8 The Contractor shall at his own expense arrange for the safety provisions as required by the Engineer-in-Charge, in respect of all labour directly or indirectly employed for performance of the Works and shall provide all facilities in connection therewith. In case the Contractor fails to make arrangements and provide necessary facilities as aforesaid, the Engineer-in-Charge shall be entitled to do so and recover the cost thereof from the Contractor. But this will not absolve the Contractor of his responsibility or otherwise thereof.

35.9 In the event of any injury, disability or death of any workmen in or about the work employed by the Contractor either directly or through his sub-contractor, Contractor shall at all times indemnify and save harmless the Employer against all claims, damages and compensation under the Workmen Compensation Act,

1923 as amended from time to time or in other law for the time being in force and rules there under from time to time and also against all costs, charges and expenses of any smooth action by proceedings arising out of such accidents or injury, disability or death of a workmen and against all sum or sums which may with the consent of the Contractor be paid to compromise or compound any claim in this regard. If any award, decree or order is passed against the Contractor for recovery of any compensation under the Workmen Compensation Act, 1923, for any injury, disability or death of a workman by any competent court, the said sum or sums shall be deducted by the Engineer-in-charge from any sum then due or that may become due to the Contractor or from his Security Deposit or sale thereof in full or part under the Contract or any other contract with the Employer towards fulfillment of the said decree, award or orders.

35.10 Provided always that the Contractor shall have no right to demand payments/claims whatsoever on account of his compliance with his obligations under this clause and Labour Regulation and the same are deemed to be covered in unit rates of BOQ items.

36. Change in Laws and Regulations

If after the date twenty-eight (28) days prior to the last date of online bid submission, in the country where the Site is located, any law, regulation, ordinance, order or bylaw 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 Employer and the Contractor and not on procurement of raw materials, intermediary components etc. by the Contractor.

However, the imposition of Basic Custom Duty (BCD) as per MNRE office memorandum no. 283/3/2018-GRID SOLAR dated 09.03.2021 shall not be considered as change in law. Bidders are advised to refer to said MNRE office memorandum dated 09.03.2021 while submitting their bids.

37. Force Majeure

37.1 "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 and shall include, without limitation, the following:

(a) war and other hostilities (whether war be declared or not), invasion, act of foreign enemies, mobilization, requisition or embargo;

(b) rebellion, revolution, insurrection, military or usurped power and civil war;

(c) ionizing radiation or contamination by radio-activity from any nuclear fuel or from any nuclear waste from the combustion of nuclear fuel,

radio-active toxic explosives, or other hazardous properties of any explosive nuclear assembly or nuclear components thereof;

(d) riot, commotion or disorder, except where solely restricted to employees of the Contractor.

(e) Acts of God such as earthquake (above magnitude of 7 of Richter Scale), lightening, unprecedented floods, spread of Pandemic where lock down/ movement restrictions are declared by Government.

37.2 If either party is prevented, hindered or delayed from or in performing any of its obligations under the Contract by an event of Force Majeure, then it shall notify the other in writing of the occurrence of such event and the circumstances thereof within fourteen (14) days after the occurrence of such event.

37.3 The party who has given such notice shall be excused from the performance or punctual performance of its obligations under the Contract for so long as the relevant event of Force Majeure continues and to the extent that such party's performance is prevented, hindered or delayed. The Time for Completion shall be extended in accordance with GCC Clause 40 (Extension of Time for Completion).

37.4 The party or parties affected by the event of Force Majeure shall use reasonable efforts to mitigate the effect thereof upon its or their performance of the Contract and to fulfill its or their obligations under the Contract, but without prejudice to either party's right to terminate the Contract under GCC Clause 42.

37.5 No delay or non-performance by either party hereto caused by the occurrence of any event of Force Majeure shall constitute a default or breach of the Contract if and to the extent that such delay or non-performance is caused by the occurrence of an event of Force Majeure.

37.6 If the performance of the Contract is substantially prevented, hindered or delayed for a single period of more than sixty (60) days or an aggregate period of more than one hundred and twenty (120) days on account of one or more events of Force Majeure during the currency of the Contract, the parties will attempt to develop a mutually satisfactory solution, failing which the dispute will be resolved in accordance with GCC, Clause 6.

37.7 The Respective parties shall bear their own cost during Force Majeure Conditions..

38. **Deleted**

H :Change in Contract Elements

39 **Change in theFacilities**

39.1 Introducing a Change

39.1.1 Subject to GCC Sub-Clauses 39.2.5 and 39.2.7, the Employer shall have the right to propose, and subsequently require, that the Engineer In-Charge order the Contractor from time to time during the performance of the Contract to make any change, modification, addition or deletion to, in or from the Facilities (hereinafter called "Change"), provided that such Change falls within the general scope of the Facilities and does not constitute unrelated work and that it 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.

39.1.2 The Contractor may from time to time during its performance of the Contract propose to the Employer (with a copy to the Engineer In-Charge) any Change that the Contractor considers necessary or desirable to improve the quality, efficiency or safety of the Facilities. The Employer may at its discretion approve or reject any Change proposed by the Contractor, provided that the Employer shall approve any Change proposed by the Contractor to ensure the safety of the Facilities.

39.1.3 Notwithstanding GCC Sub-Clauses 39.1.1 and 39.1.2, no change made necessary because of any default of the Contractor in the performance of its obligations under the Contract shall be deemed to be a Change, and such change shall not result in any adjustment of the Contract Price or the Time for Completion.

39.1.4 The procedure on how to proceed with and execute Changes is specified in GCC Sub-Clauses 39.2 and 39.3.

39.2 Changes Originating from Employer

39.2.1 If the Employer proposes a Change pursuant to GCC Sub-Clause 39.1.1, it shall send to the Contractor a "Request for Change Proposal," requiring the Contractor to prepare and furnish to the Engineer-In-Charge as soon as reasonably practicable a "Change Proposal," which shall include the following:

(a) brief description of the Change

(b) effect on the Time for Completion

(c) estimated cost of the Change

(d) effect on Functional Guarantees (if any)

(e) effect on the Facilities

(f) effect on any other provisions of the Contract.

39.2.2 Prior to preparing and submitting the "Change Proposal," the Contractor shall submit to the Engineer In-Charge an "Estimate for Change Proposal," which shall be an estimate of the cost of preparing and submitting the Change Proposal.

Upon receipt of the Contractor's Estimate for Change Proposal, the Employer shall do one of the following:

(a) accept the Contractor's estimate with instructions to the Contractor to proceed with the preparation of the Change Proposal

(b) advise the Contractor of any part of its Estimate for Change

Proposal that is unacceptable and request the Contractor to review its estimate

(c) advise the Contractor that the Employer does not intend to proceed with the Change.

39.2.3 Upon receipt of the Employer's instruction to proceed under GCC Sub-Clause 39.2.2 (a), the Contractor shall, with proper expedition, proceed with the preparation of the Change Proposal, in accordance with GCC Sub-Clause 39.2.1.

39.2.4 The pricing of any Change shall, as far as practicable, be calculated in accordance with the rates and prices included in the Contract. If such rates and prices are inequitable, the Parties thereto shall agree on specific rates for the valuation of the Change.

39.2.5 If before or during the preparation of the Change Proposal it becomes apparent that the aggregate effect of compliance therewith and with all other Change Orders that have already become binding upon the Contractor under this GCC Clause 39 would be to increase or decrease the Contract Price as originally set forth in Article 2 (Contract Price) of the Contract Agreement by more than fifteen percent (15%), the Contractor may give a written notice of objection thereto prior to furnishing the Change Proposal as aforesaid. If the Employer accepts the Contractor's objection, the Employer and the Contractor shall agree on specific rates for valuation of the change.

The Contractor's failure to so object shall neither affect its right to object to any subsequent requested Changes or Change Orders herein, nor affect its right to take into account, when making such subsequent objection, the percentage increase or decrease in the Contract Price that any Change not objected to by the Contractor represents.

39.2.6 If 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. Upon receipt of the Change Proposal, the Employer and the Contractor shall mutually agree upon all matters therein contained. Within fourteen (14) days after such agreement, the Employer shall, if it intends to proceed with the Change, issue the Contractor with a Change Order.

If the Employer is unable to reach a decision within fourteen (14) days, it shall notify the Contractor with details of when the Contractor can expect a decision.

If the Employer decides not to proceed with the Change for whatever reason, it shall, within the said period of fourteen (14) days, notify the Contractor accordingly. Under such circumstances, the Contractor shall be entitled to reimbursement of all costs reasonably incurred by it in the preparation of the Change Proposal, provided that these do not exceed the amount given by the Contractor in its Estimate for Change Proposal submitted in accordance with GCC Sub-Clause 39.2.2.

39.2.7 If the Employer and the Contractor cannot reach agreement on the price for the Change, an equitable adjustment to the Time for Completion, or any other matters identified in the Change Proposal, the Employer may nevertheless instruct the Contractor to proceed with the Change by issue of a "Pending Agreement Change Order."

Upon receipt of a Pending Agreement Change Order, the Contractor shall immediately proceed with effecting the Changes covered by such Order. The Parties shall thereafter attempt to reach agreement on the outstanding issues under the Change Proposal.

If the Parties cannot reach agreement within sixty (60) days from the date of issue of the Pending Agreement Change Order in terms of clause 6.1 & 6.2, then the matter may be referred for Arbitration/CCIE in accordance with the provisions of GCC Sub-Clause 6.3 (Arbitration)/Clause 6.4.

39.3 Changes Originating from Contractor

39.3.1 If the Contractor proposes a Change pursuant to GCC Sub-Clause 39.1.2, the Contractor shall submit to the Engineer In-Charge a written "Application for Change Proposal," giving reasons for the proposed Change and including the information specified in GCC Sub-Clause 39.2.1.
Upon receipt of the Application for Change Proposal, the Parties shall follow the procedures outlined in GCC Sub-Clauses 39.2.6 and 39.2.7. However, should the Employer choose not to proceed, the Contractor shall not be entitled to recover the costs of preparing the Application for Change Proposal.

40. Extension of Time for Completion

40.1 The Time(s) for Completion for EPC works specified in the Contract shall be extended if performance of any of its obligations under the Contract is delayed or impeded due to any of the following reasons:

(a) any occurrence of Force Majeure as provided in GCC Clause 37 (Force Majeure),

(b) any suspension order given by the Employer under GCC Clause 41 (Suspension) hereof

(c) any changes in laws and regulations as provided in GCC Clause 36 (Change in Laws and Regulations) or

(d) any other matter specifically mentioned in the Contract;

by such period as shall be fair and reasonable in all the circumstances and as shall fairly reflect the delay or impediment sustained by the Contractor.

40.2 Except where otherwise specifically provided in the Contract, the Contractor shall submit to the Engineer In-Charge a notice of a claim for an extension of the Time for Completion, together with particulars of the event or circumstance justifying such extension as soon as reasonably practicable after the commencement of such event or circumstance. As soon as reasonably practicable after receipt of such notice and supporting particulars of the claim, the Employer and the Contractor shall agree upon the period of such extension. In the event that the Contractor does not accept the Employer's estimate of a fair and reasonable time extension, the Contractor shall be entitled to refer the matter for settlement pursuant to GCC Sub-Clause 6.

40.3 The Contractor shall at all times use its reasonable efforts to minimize any delay in the performance of its obligations under the Contract.

41. Suspension

41.1 The Employer, through the Engineer In Charge, by notice to the Contractor, order the Contractor, to suspend performance of any or all of its obligations under the Contract. Such notice shall specify the obligation of which performance is to be suspended, the effective date of the suspension and the reasons thereof. The Contractor shall thereupon suspend performance of such obligation (except those obligations necessary for the care or preservation of the Facilities) until ordered in writing to resume such performance by the Engineer In-Charge.

If, by virtue of a suspension order given by the Engineer In-Charge, other than by reason of the Contractor's default or breach of the Contract, the Contractor's performance of any of its obligations is suspended for an aggregate period of more than ninety (90) days, then at any time thereafter and provided that at that time such performance is still suspended, the Contractor may give a notice to the Engineer In-Charge requiring that the Employer shall, within twenty-eight (28) days of receipt of the notice, order the resumption of such performance excluding the performance of the suspended obligations from the Contract.

If the Employer fails to do so within such period, the Contractor may, by a further notice to the Engineer In-Charge, elect to treat the suspension, where it affects a part only of the Facilities, as a deletion of such part or, where it affects the whole of the Facilities, as termination of the Contract under GCC Sub-Clause 42.1 (Termination for Employer's Convenience).

41.2 If the Employer has failed to pay the Contractor any sum due under the Contract within the specified period, has failed to approve any invoice or supporting documents without just cause pursuant to Appendix 1 (Terms and Procedures of Payment) to the Contract Agreement, or commits a substantial breach of the Contract, the Contractor may give a notice to the Employer that requires payment of such sum, with interest thereon as stipulated in GCC Sub-Clause 12.3, requires approval of such invoice or supporting documents, or specifies the breach and requires the Employer to remedy the same, as the case may be. If the Employer fails to pay such sum together with such interest, fails to approve such invoice or supporting documents or give its reasons for withholding such approval, or fails to remedy the breach or take steps to remedy the breach within fourteen (14)

days after receipt of the Contractor's notice then the Contractor may by fourteen (14) days' notice to the Employer suspend performance of all or any of its obligations under the Contract, or reduce the rate of progress.

41.3 If the Contractor's performance of its obligations is suspended or the rate of progress is reduced pursuant to this GCC Clause 41, then the Time for Completion shall be extended in accordance with GCC Sub-Clause 40.1, and any and all additional costs or expenses incurred by the Contractor as a result of such suspension or reduction shall be paid by the Employer to the Contractor in addition to the Contract Price, except in the case of suspension order or reduction in the rate of progress by reason of the Contractor's default or breach of the Contract.

41.4 During the period of suspension, the Contractor shall not remove from the Site any Plant and Equipment, any part of the Facilities or any Contractor's Equipment, without the prior written consent of the Employer which shall not be unreasonably withheld.

42. Termination

42.1 Termination for Employer's Convenience

42.1.1 The Employer may at any time terminate the Contract for any reason by giving the Contractor a notice of termination that refers to this GCC Sub-Clause 42.1.

42.1.2 Upon receipt of the notice of termination under GCC Sub-Clause 42.1.1, 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 Employer may specify in the notice of termination for the sole purpose of protecting that part of the Facilities 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 Employer pursuant to paragraph (d)(ii) below

(c) remove all Contractor's Equipment from the Site, repatriate the Contractor's and its Subcontractors' 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 Sub-Clause 42.1.3, shall

(i) deliver to the Employer the parts of the Facilities executed by the Contractor up to the date of termination

(ii) to the extent legally possible, assign to the Employer all right, title and benefit of the Contractor to the Facilities and to the Plant and Equipment as at the date of termination, and, as may be required by the Employer, in any subcontracts concluded between the Contractor and its Subcontractors

(iii) deliver to the Employer all non-proprietary drawings, specifications and other documents prepared by the Contractor or its Subcontractors as at the date of termination in connection with the Facilities.

42.1.3 In the event of termination of the Contract under GCC Sub-Clause 42.1.1, the Employer shall pay to the Contractor the following amounts:

(a) the Contract Price, properly attributable to the parts of the Facilities 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 Subcontractors' personnel

(c) any amounts to be paid by the Contractor to its Subcontractors in connection with the termination of any subcontracts, including any cancellation charges

(d) costs incurred by the Contractor in protecting the Facilities and leaving the Site in a clean and safe condition pursuant to paragraph (a) of GCC Sub-Clause 42.1.2

(e) 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.

42.2 **Termination for Contractor's Default**

42.2.1 The Employer, 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 therefor to the Contractor, referring to this GCC Sub-Clause 42.2:

(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 the provision of GCC Clause 43 (Assignment).

(c) if the Contractor, in the judgment of the Employer has engaged in corrupt or fraudulent or collusive or coercive practices in competing for or in execution the Contract

For the purpose of this Sub-Clause:

"**Corrupt practice**" means the offering, giving, receiving or soliciting of anything of value to influence the action of a public

official in the procurement process or in contract execution.

"**Fraudulent practice**" means a misrepresentation of facts in order to influence a procurement process or the execution of a contract to the detriment of the Employer 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 Employer of the benefits of free and open competition.

"**Collusive Practice**" means a scheme or arrangement between two or more bidders, with or without the knowledge of Employer, designed to establish bid prices at artificial, non-competitive levels.

"**Coercive Practice**" means harming or threatening to harm, directly or indirectly, person or their property to influence their participation in a procurement process or affect the execution of Contract.

42.2.2 If the Contractor

(a) has abandoned or repudiated the Contract, or

(b) has without valid reason failed to commence work on the Facilities promptly or has suspended (other than pursuant to GCC Sub-Clause 41.2) the progress of Contract performance for more than twenty-eight (28) days after receiving a written instruction from the Employer to proceed, or

(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, or

(d) refuses or is unable to provide sufficient materials, services or labour to execute and complete the Facilities in the manner specified in the program furnished under GCC Clause 18 (Program of Performance) at rates of progress that give reasonable assurance to the Employer that the Contractor can attain Completion of the Facilities by the Time for Completion as extended,

then, the Employer 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 fourteen (14) days of its receipt of such notice, then the Employer may terminate the Contract forthwith by giving a notice of termination to the Contractor that refers to this GCC Sub-Clause 42.2.

42.2.3 Upon receipt of the notice of termination under GCC Sub-Clauses 42.2.1 or 42.2.2, 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 Employer

may specify in the notice of termination for the sole purpose of protecting that part of the Facilities 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 Employer pursuant to paragraph (d) below,

(c) deliver to the Employer the parts of the Facilities executed by the Contractor up to the date of termination,

(d) to the extent legally possible, assign to the Employer all right, title and benefit of the Contractor to the Works and to the Plant and Equipment as at the date of termination, and, as may be required by the Employer, in any subcontracts concluded between the Contractor and its Subcontractors and

(e) deliver to the Employer all non-proprietary drawings, specifications and other documents prepared by the Contractor or its Subcontractors as at the date of termination in connection with the Facilities.

42.2.4 The Employer may enter upon the Site, expel the Contractor, and complete the Facilities itself or by employing any third party. The Employer 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 Employer and with an indemnification by the Employer for all liability including damage or injury to persons arising out of the Employer's use of such equipment, any Contractor's Equipment owned by the Contractor and on the Site in connection with the Facilities for such reasonable period as the Employer considers expedient for the supply and installation of the Facilities.

Upon completion of the Facilities or at such earlier date as the Employer thinks appropriate, the Employer 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.

42.2.5 Subject to GCC Sub-Clause 42.2.6, the Contractor shall be entitled to be paid the Contract Price attributable to the Facilities executed as at the date of termination, the value of any unused or partially used Plant and Equipment on the Site, and the costs, if any, incurred in protecting the Facilities and in leaving the Site in a clean and safe condition pursuant to paragraph (a) of GCC Sub-Clause 42.2.3. Any sums due to the Employer from the Contractor accruing prior to the date of termination shall be deducted from the amount to be paid to the Contractor under this Contract.

42.2.6 If the Employer completes the Facilities, the cost of completing the Facilities by the Employer shall be determined.

If the sum that the Contractor is entitled to be paid, pursuant to GCC Sub-Clause 42.2.5, plus the reasonable costs incurred by the Employer in completing the Facilities, exceeds the Contract Price, the Contractor shall be liable for such excess.

If such excess is greater than the sums due the Contractor under GCC Sub-Clause 42.2.5, the Contractor shall pay the balance to the Employer.

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

42.3 **Termination by Contractor**

42.3.1 If the Employer has failed to pay the Contractor any sum due under the Contract within the specified period, has failed to approve any invoice or supporting documents without just cause pursuant to Appendix 1 (Terms and Procedures of Payment) of the Contract Agreement, or commits a substantial breach of the Contract, the Contractor may give a notice to the Employer that requires payment of such sum, with interest thereon as stipulated in GCC Sub-Clause 12.3, requires approval of such invoice or supporting documents, or specifies the breach and requires the Employer to remedy the same, as the case may be. If the Employer fails to pay such sum together with such interest, fails to approve such invoice or supporting documents or give its reasons for withholding such approval, fails to remedy the breach or take steps to remedy the breach within sixty (60) days after receipt of the Contractor's notice, then, the Contractor may give a notice to the Employer thereof, and if the Employer has failed to pay the outstanding sum, to approve the invoice or supporting documents, to give its reasons for withholding such approval, or to remedy the breach within twenty-eight (28) days of such notice, or if the Contractor is still unable to carry out any of its obligations under the Contract for any reason attributable to the Employer within twenty-eight (28) days of the said notice, the Contractor may by a further notice to the Employer referring to this GCC Sub-Clause 42.3.1, forthwith terminate the Contract.

42.3.2 The Contractor may terminate the Contract forthwith by giving a notice to the Employer to that effect, referring to this GCC Sub-Clause 42.3.2, if the Employer becomes bankrupt or insolvent, has a receiving order issued against it, compounds with its creditors, or, being a corporation, if 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 Employer takes or suffers any other analogous action in

consequence of debt.

42.3.3 If the Contract is terminated under GCC Sub-Clauses 42.3.1 or 42.3.2, then the Contractor shall immediately

(a) cease all further work, except for such work as may be necessary for the purpose of protecting that part of the Facilities 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 Employer pursuant to paragraph (d)(ii)

(c) remove all Contractor's Equipment from the Site and repatriate the Contractor's and its Subcontractor's personnel from the Site

(d) In addition, the Contractor, subject to the payment specified in GCC Sub-Clause 42.3.4, shall

(i) deliver to the Employer the parts of the Facilities executed by the Contractor up to the date of termination

(ii) to the extent legally possible, assign to the Employer all right, title and benefit of the Contractor to the Facilities and to the Plant and Equipment as of the date of termination, and, as may be required by the Employer, in any subcontracts concluded between the Contractor and its Subcontractors

(iii) deliver to the Employer all drawings, specifications and other documents prepared by the Contractor or its Subcontractors as of the date of termination in connection with the Facilities.

42.3.4 If the Contract is terminated under GCC Sub-Clauses 42.3.1 or 42.3.2, the Employer shall pay to the Contractor all payments specified in GCC Sub-Clause 42.1.3.

42.3.5 Termination by the Contractor pursuant to this GCC Sub-Clause 42.3 is without prejudice to any other rights or remedies of the Contractor that may be exercised in lieu of or in addition to rights conferred by GCC Sub-Clause 42.3.

42.4 In GCC Clause 42, the expression "Facilities executed" shall include all work executed, Installation Services provided, any all Plant and Equipment 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 Facilities, up to and including the date of termination.

42.5 In this GCC Clause 42, in calculating any payment due from the Employer to the Contractor, account shall be taken of any sum previously paid by the Employer to the Contractor under the Contract, including any advance payment paid pursuant to Appendix 1 (Terms and Procedures of Payment) to the Contract Agreement.

42.6 **TERMINATION OF CONTRACT ON DEATH**

If the Contractor is an individual or a proprietary concern and the individual or the proprietor dies, or if the Contractor is a partnership concern and one of the partners dies, then, unless the Engineer-in-Charge is satisfied that the legal representatives of the individual Contractor or of the proprietor of the proprietary concern and in the case of partnership, the surviving partners are capable of carrying out and completing the contract, the Engineer-in-Charge shall be entitled to terminate the Contract as to its uncompleted part without the Employer being in any way liable to payment of any compensation whatsoever on any account to the estate of the deceased Contractor and/or to the surviving partners of the Contractor's firm on account of termination of the Contract. The decision of the Engineer-in-Charge that the legal representatives of the deceased Contractor or the surviving partners of the Contractor's firm cannot carry out and complete the Works under the Contract shall be final and binding on the parties. In the event of such termination, the Corporation shall not hold the estate of the deceased Contractor and/or the surviving partners of the
Contractors firm liable for damages for not completing the Contract. Provided that the power of the Engineer-in- charge of such termination of Contract shall be without prejudice to any other right or remedy, which shall have accrued or shall accrue to him under the Contract.

43. **ASSIGNMENT**

Neither the Employer nor the Contractor shall, without the express prior written consent of the other party (which consent shall not be unreasonably withheld), assign to any third party the Contract or any part thereof, or any right, benefit, obligation or interest therein or there under, except that the Contractor shall be entitled to assign either absolutely or by way of charge any moneys due and payable to it or that may become due and payable to it under the Contract.

44. **REMOVAL OF CONTRACTOR'S MEN**

The Contractor shall employ on the execution of the Works only such persons as are skilled and experienced in their respective trades and the Engineer-in-Charge shall be at liberty to object to and require the Contractor to remove from the works any persons employed by the Contractor on the execution of the works who, in the opinion of the Engineer-in-Charge, misconducts himself or is incompetent or negligent in the proper performance of his duties. The Contractor shall forth-with comply with such requisition and such person shall not be again employed upon the works without permission of the Engineer-in- charge. Any person so removed shall be replaced immediately.

45. **MATERIALS OBTAINED FROM EXCAVATION AND TREASURE, TROVE, FOSSILS ETC**

(i) Materials of any kind obtained from excavation on the Site shall remain the property of the Employer and shall be disposed off as directed by the Engineer-in-

Charge.

(ii) However, if any of the materials thus obtained from excavation on the site is such as can be used in the execution of the Works under the Contract, the Contractor will be allowed to use the same free of cost (except that any amount of royalty, levies are paid by the Contractor) for the aforesaid purposes provided the same is found suitable and is approved by the Engineer-in-Charge.

(iii) Fossils, coins, articles of value, structures and other remains or things of geological or archeological interest discovered on the site shall be the absolute property of the Employer. The Contractor shall take reasonable precautions to prevent his labour or any other person from removing or damaging any such article or thing and shall immediately upon the discovery thereof and before removal acquaint the Engineer-in-Charge with such discovery and carry out the Engineer-in-Charge's directions as to the disposal of the same at the expense of the Employer.

46. TRAINING OF APPRENTICES

The Contractor shall, during the currency of the Contract, engage and also ensure engagement by his sub-contractor and other employed by the Contractor in connection with the Works, such number of apprentices and in such categories for such periods as may be required under the Apprenticeship Act 1961 as amended in 2014 and he shall be responsible for all obligations of the Employer under the aforesaid Act, including the liability to make payment to Apprentices as required under the Act.

47. ECOLOGICAL BALANCE

47.1 The Contractor shall be required to ensure that there shall be no indiscriminate felling of trees by him or his labourers or their family members and he will be solely responsible for their acts in this regard. The Contractor shall try to maintain ecological balance by preventing deforestation, water pollution and defacing of natural landscape in the vicinity of work areas. The Contractor shall so conduct his construction operations as to prevent an unnecessary destruction of, scarring or defacing the natural surroundings in the vicinity of the work area. In order to maintain the ecological balance, the Contractor shall specifically observe the following instructions:

a) Where unnecessary destruction, scarring, damage or defacing may occur as a result of the Contractor's operation, the same shall be repaired, replanted or otherwise corrected at the Contractor's expense. The Contractor will prevent scattering of rocks and other debris outside the work areas. All work areas shall be smoothed and graded in a manner to conform to the natural appearance of the landscape as directed by the Engineer-in-Charge.

b) All trees and shrubs, which are not specifically required to be cleared or removed for construction purposes, shall be preserved and shall be protected from any damage that may be caused by the Contractor's construction operation and equipment. The removal of trees or shrubs will be permitted only after prior approval by the Engineer-in-charge. Special care shall be exercised where trees or shrubs are exposed to

injuries by construction equipment, blasting, and excavating, dumping, chemical damage or other operation and the Contractor shall adequately protect such trees by use of protective barriers or other methods approved by the Engineer-in-Charge. Trees shall not be used for anchorage.

c) The Contractor's construction activities shall be performed by methods that will prevent entrance or accidental spillage of solid matter contaminants, debris and other objectionable pollutants and wastage into river. Pollutants and wastes shall be disposed of in a manner and at sites approved by the Engineer in-Charge. The Contractor shall fully comply with Water (Prevention and Control of Pollution) Act, 1974 section - 33(A).

d) In the Conduct of construction activities and operation of equipment, the Contractor shall utilize such practicable methods and devices as are reasonably available to control, prevent and otherwise minimize air pollution. The contractor shall fully comply with Air (Prevention and Control of Pollution) Act, 1981 section -31(A).

e) Burning of materials resulting from clearing of tree, bush, combustible construction materials and rubbish may be permitted only when atmospheric conditions for burning are considered favourable.

f) The Contractor shall be required to prevent flowing of debris and muck in to the river. Necessary retaining structures like walls/crates etc. shall be constructed for the purpose. The Contractor shall also stabilize the muck fully i.e. consolidation and compaction of the muck shall be carried out in the muck dumpsites before handing it over to the Employer at the end of construction period.

g) All the equipment which are likely to generate high noise levels are to be fully equipped (with noise reduction measures) to meet the ambient noise control standards.

47.2 Separate payment will not be admissible to the Contractor for complying with the provisions of this clause except the protection work as specially provided for in BOQ. All other costs shall be deemed to have been included in the items mentioned in the Bill of Quantities. If any provision(s) is not complied with, within a reasonable time even after issue of a notice in this respect, the necessary operations would be carried out by the Engineer-in-charge at the cost of the Contractor

48 SHORT CLOSURE OF THE PROJECT

If the Contractor has partially commissioned the Project i.e. minimum 80% portion of the ordered project capacity at offered site & Employer has started receiving revenue / benefit from such partially commissioned Project and if balance project capacity is not executable at that site, then Employer shall accept the such partially commissioned project and release all the payment under agreed payment terms clause for such partially commissioned project on pro-rata basis, provided all the activities has been carried out for completion of such partially commissioned project to be accepted. This shall be considered as short closing of the Project and Contractor shall be relieved of his pending obligations.

The Contractor shall be paid at Contract rates for full amount of the works executed at Site and, in addition, a reasonable amount as certified by the Engineer-in-Charge for the items which could not be utilized on the works to the full extent because of the foreclosure. However, the Contractor shall have no claim to any payment of compensation or otherwise whatsoever, on account of any profit or advantage which he might have derived from the execution of the works in full but which he could not derive in consequence of the fore closure of the whole or part of the Works.

49 EMPLOYMENT OF SKILLED / SEMISKILLED WORKERS

The contractor shall at all stages of work, deploy skilled / semi-skilled tradesmen who are qualified and possess certificate in particular trade from CPWD Training Institute / Industrial Training Institute / National Institute of construction Management and Research (NICMAR) / National Academy of Construction, CIDC or any similar reputed and recognized Institute managed / certified by State /Central Government. The number of such qualified tradesmen shall not be less than 20% of total skilled / semi-skilled workers required in each trade at any stage of work.

The contractor shall submit number of man days required in respect of each trade, it's scheduling and the list of qualified tradesmen along with requisite certificate from recognized Institute to Engineer – in – charge for approval. Notwithstanding such approval, if the tradesmen are found to have inadequate skill to execute the work of respective trade, the contractor shall substitute such tradesmen within two days of written notice from Engineer – in – charge. Failure on the part of contractor to obtain approval of Engineer – in –charge or failure to deploy qualified tradesmen will attract a compensation to be paid by contractor at the rate of Rs.100 per such tradesman per day. Decision of Engineer –in – charge as to whether particular tradesman possesses requisite skill and amount of compensation in case of default shall be final and binding.

50 GENERAL

Save and except as expressly provided elsewhere in this Contract all costs, expenses, charges and liabilities for the completion of the Works in accordance with the Contract and/or for the due and faithful performance and/or the fulfillment of all of the Contractor's obligations under the Contract including furnishing of bank guarantees to the Employer pursuant to the Contract shall be to the account of and be borne by the Contractor and shall be deemed to be included in the unit rates provided for in the Bill of Quantities and the Employer shall not be liable in any manner whatsoever therefore.

Whenever any claim whatsoever for the payment of a sum of money to the Employer arises out of or under this contract against the Contractor, the same may be deducted by the Employer from any sum then due or which at any time thereafter may become due to the Contractor under this Contract and failing, that under any other contract between the Employer and the Contractor or from any other sum whatsoever due to the Contractor from the Employer or from his Security Deposit or he shall pay the claim on demand.

GCC ANNEXURE- I

I. Standard Operating Procedure (SoP) for Independent Engineer (IE):-

i) IE shall act as per the Standard Operating Procedures (SOPs) attached at Annexure-A.
ii) Resolution by IE shall commence when the claimant Party submits detailed information as per Standard Format for Disagreement Case filing attached as Annexure-B, to IE for intervention along with the necessary documentary evidences. Demand for IE intervention will not be admissible without initial documentary evidence.
iii) Necessary information sought by IE during the course of investigation shall be provided in a time bound manner by both the Parties and non-compliance of the same shall lead to imposition of penalties.
iv) IE will examine the issue(s) raised by the Parties concerned as mentioned at point number (ii) above by conducting inspections involving field measurements as may be required to further investigate and to also conduct hearing/mediation with both the parties.
v) Based on the preliminary hearing of the parties, IE shall prescribe resolution timeline depending upon the number and nature of disagreements subject to a maximum duration of thirty (30) days or within extended timeline under extraordinary circumstances and for reasons to be recorded in writing.
vi) There shall not be any conflict of interest and it shall be ensured that IE should not have been engaged for providing any other services to any of the parties i.e. either Employer or Contractor in the last three years.
vii) In the event of non-performance of obligations/services by the IEs at any time during the duration of its contract, the Employer and the Contractor, on mutually agreed basis, shall have the right and discretion to terminate IEs contract by giving a termination notice of thirty (30) days to IEs**.**

II Terms and Conditions for Payments to 'Independent Engineer' –

a) Retainership Fee : A retainer fee of Rs.100,000 per month (Base Financial year: 2021-22) for 'Independent Engineer' shall be considered as payment in full for :
   i) being available on a notice of 2 weeks for all site visits and hearings;
   ii) becoming and remaining conversant with all the project developments and maintaining relevant files;
   iii) compensating all office and overhead expenses including secretarial services, photocopying and office supplies incurred in connection with his duties; and

   The retainer fee of Experts, shall be increased annually by 10%. Further, an Expert, shall not be in the retainership of more than two contracts concurrently in the NHPC. In case of two contracts, expert shall draw retainership fee limited to one contract only. The duration of retainership shall be for such duration as may be mutually decided by the Employer and Contractor but shall not, in any case, extend beyond 3 months after the completion of works as per the contract. The retainership fee shall be shared by the Employer and the Contractor equally but shall initially be paid to the IE by the Employer**.**

b) Site visit Fee: A daily visiting fee of Rs 20,000/- (Base Financial year: 2021-22) to either project site or project office, anywhere in India, limited to a maximum of 10 days in a month for Expert, shall be paid for hearing, preparing reports etc initially by the Employer. The daily visiting fee of Expert, as mentioned above, shall be increased on yearly basis @10%.

c) Reimbursement of travel, boarding/lodging expenses incurred by 'Independent Engineer': The travel, boarding/lodging expenses of the 'Independent Engineer', as per entitlement of Executive Director of NHPC, would be made initially by the Employer or Contractor. If any expert of 'Independent Engineer' does not receive payment of the amount due within 30 days after submitting claim, the expert shall be free to suspend his/her services without notice until the payment is received**.**

d) Meeting Expenses: All the payments for holding the meeting would be initially borne by the Client i.e. Employer or Contractor, as the case may be, and shall be shared equally by the Employer and Contractor.

e) Sharing of Expenses on Independent Engineer : All the payments for holding the meeting, site visits, reimbursement of travel, boarding/lodging expenses and monthly compensation of 'Independent Engineer' shall be shared equally by both the parties i.e. Employer and Contractor.

f) Audit: NHPC shall maintain an account of all the expenses incurred by it on 'Independent Engineer' and such account shall be subject to Audit.

Annexure-A to GCC ANNEXURE-I

Standard Operating Procedures (SOPs) for working of Independent Engineer (IE)

Investigations by Independent Engineer for any contentious issue / disagreement shall be as per pre-defined Standard Operating Procedure (SOP). IE shall strictly follow the SOPs and will also document and maintain all the records, Following is a representation of the SOPs for IE for processing key tasks, roles and responsibilities and commensurate timelines.

Based on the preliminary hearing of the Parties, IE shall prescribe resolution timeline depending upon the number and nature of disagreements subject to a maximum duration of thirty (30) days.

Sr. No.	Key Tasks	Stakeholder Involvement	Activity Description	Timeline
1	Disagreement Filing	Contractor & Employer	**Case Filing -** A disagreement case begins when claimant party submits a demand for intervention by IE in the prescribed format along with documentary evidence. Demand without initial documentary evidence will not be admissible for IE intervention.	Day-0
2	Preliminary Hearing & Scheduling	Independent Engineer, Contractor & Employer	**Preliminary Hearing & Scheduling process** – IE to organize a preliminary hearing with the parties and prescribe suitable timeline for resolution or settlement.	Day-1 to 6
3	Finalization of Issues	Independent Engineer	**Finalization of Issues –** After due examination and diligence to finalize the issues requiring resolution.	Day-3 to 9
4	Hearing / Mediation	Independent Engineer, Contractor & Employer.	**Hearing / Mediation-** The parties and IE meet in person to conduct the Hearings.	Day-4 to 12
5	Inspection	Independent Engineer	**Inspection -** IE conducts the inspections involving field measurements, if any, to further investigate evidence conferred to the IE by both parties during the	Day-5 to 17

Sr. No.	Key Tasks	Stakeholder Involvement	Activity Description	Timeline
			hearing.	
6	Post Inspection Briefs	Independent Engineer, Contractor & Employer	**Post Inspection Briefs -** After the inspection takes place; both the parties may come up with additional testimony, as permitted by the IE.	Day-10 to 30
7	Closure	Independent Engineer	**Closure -** IE closes the report on the case and issues a decision, along with any claim settlement, if applicable.	Day-10 to 30

Annexure-B to GCC ANNEXURE- I

Standard Format for Disagreement Case Filing (Indicative)

Standard Format for Disagreement Case Filing *(Indicative)*

In line with the SOPs, an IE expert should follow a standard format provided below for disagreement case filing and further investigations.

Disagreement Documentation Report (to be filled by Independent Engineer)

1. Name of Party	2. Disagreement Reporting Date	3. Has the documentary Evidence been Submitted
		☐ Yes ☐ No ☐ Not Applicable
4. Contract Reference number	5. Party Representative Name Reporting Disagreement Name: Contact Details:	
6. Name of Independent Engineer(IE)	7. IE Contact details	8. Disagreement Reference Number Allocated by IE

9. Supplementary Note Recording the Disagreement

[Text]

Documentary Evidences to be Annexed

10. Critical Engineering Expertise Relevant to investigate the Disagreement (Check All Required)

☐ Engineering Design ☐ Geology ☐ Civil Works ☐ Hydro Mechanical ☐ Electro Mechanical ☐ Electrical Switchgear ☐ Quality Assurance & Inspection

11. Record Notes of Preliminary hearing Organized by IE with the parties

[Text]

Documentary Evidences by Parties along with MoM to be Annexed

12. Brief Narration on discovery process - after Preliminary hearing & listing of next step to examine the issues and procedural difficulties relating to the case

[Text]

Documentary Evidences to be Annexed

13. Record notes of Hearing/Mediation between the parties and IE

[Text]

Documentary Evidences with Video Records to be Annexed

14. Inspection Records with Field Measurements Conducted by IE

[Text]

Documentary Evidences to be Annexed

15. Record notes of Inspection Briefs by IE along with additional testimony by the Parties if any

[Text]

Documentary Evidences & Inspection Reports to be Annexed

16. Closure Report by IE with Decision & Claim settlement if applicable

[Text]

Documentary Evidences to be Annexed

Final Acceptance by All the Parties

GCC Annexure-II

PANEL OF EXPERTS AS "INDEPENDENT ENGINEER

	Name	Date of Birth	Post held immediately before retirement	Contact Details	
	Ravinder Kumar Sharma	10.02.1947	CMD, THDC India Limited	9810137215 rks98101@hotmail.com	
	Chander Mohan Walia	10.11.1949	Director (Electrical), HPPCL and Member (Technical), HPSEB	9418031231 cmwaIia1949@gmail.com	
	Arun Kumar	22.12.1950	Member (Projects), HP State Electricity Board	9816600130 arunkumar@jayahydro.com	
	Dr. A.K. Lamas	18.09.1951	CMD, MECL and ED, NHPC Ltd.	9810212274 aklomas@gmail.com	
	Vinod Kumar Kapoor	21.07.1954	ED, NHPC; President/ Project Management Engineer for Hydropower Projects, Bhilwara Energy Ltd.	9599207052/ 9958466211 kapoorveekay@yahoo.co.in	
	Om Prakash	01.04.1957	Executive Director, NHPC Ltd.	8527724400 omprakash1957@gmail.com	
	Krishna Deo Sah	04.07.1957	Executive Director, NHPC Ltd.	9797793514 kdsah.2008@rediffmaiI.com	
	P.P.S. Mann	09.06.1957	Executive Director, THDC India Ltd. & Head of Project of Tehri Power Complex.	7351901352/ 7277630000 pps3mann@gmaiI.com	
	Rajesh Kumar Chaudhary	19.11.1957	Executive Director, NHPC Ltd.	9650088562 rajesh1957chaudhary@gmaiI.com	
	Ramesh Narain Misra	20.11,1957	CMD, SJVN Ltd.	9958111243 rnmisra1957@gmaiI.com	

	Name	**Date of Birth**	**Post held immediately before retirement**	**Contact Details**	
	Janki Prasad	14.12.1957	Chief Engineer (HPM), Central Electricity Authority, New Delhi	9868555133 jpg57@rediffmaiI.com	
	Kanwar Singh	13.03.1959	Director (Civil), SJVN Ltd.	9810519883 kanwarsinghpc@yahoo.co.in ksnhpc@gmail.com	
	Rakesh	20.05.1960	Executive Director, NHPC Ltd.	8811072000 9810330826 rake_sh@hotmaiI.com	
	Anand Kumar Gupta	15.07.1960	Director (Commercial), NTPC Limited	9650992233 akgupta521@gmail.com	
	Rajesh Kumar Jaiswal	29.09.1960	Executive Director, NHPC Ltd.	8826006998 rajesh9285@gmaiI.com	
	Muhar Mani	14.12.1960	Executive Director (OMS, QA, Safety/Corporate Planning Monitoring & project Service), THDC, Rishikesh	9411106931 manimuhar@gmail.com	
	Kanwar Pal Singh	01.03.1961	Executive Director, Engineer in Charge of Tehri Pumped Storage Plant and Vishnugad Pipalkoti H.E. Project,THDC India Limited.	9412076324 kpstomar@rediffmail.com	
	Dhirendra Veer Singh	02.04.1961	CMD, THDC India Limited	9411103546 dvsingh01@yahoo.com	
	Suresh Chandra Pal	04.07.1961	Executive Director, NHPC Ltd.	7042711944 scpaI02@yahoo.com	

GCC Annexure III

NHPC Schedule of Arbitrators fees				
Sum in Dispute	**Arbitrator I**	**Arbitrator II**	**Arbitrator III**	**Total Fees**
Upto Rs 5,00,000/-	Rs. 15000/-	Rs. 15000/-	Rs. 15000/-	Rs. 45,000/-
Above Rs. 5,00,000/- and upto Rs. 20,00,000/-	Rs. 15000 plus 3.5% of 1/3 of claim amount over and above Rs. 5,00,000/-	Rs. 15000 plus 3.5% of 1/3 of claim amount over and above Rs. 5,00,000/-	Rs. 15000 plus 3.5% of 1/3 of claim amount over and above Rs. 5,00,000/-	Rs. 45000 plus 3.5% of claim amount over and above Rs. 5,00,000/-
Above Rs. 20,00,000/- and upto Rs. 1,00,00,000/-	Rs. 32500 plus 3% of 1/3 of claim amount over and above Rs. 20,00,000/-	Rs. 32500 plus 3% of 1/3 of claim amount over and above Rs. 20,00,000/-	Rs. 32500 plus 3% of 1/3 of claim amount over and above Rs. 20,00,000/-	Rs. 97500 plus 3% of 1/3 of claim amount over and above Rs. 20,00,000/-
Above Rs. 1,00,00,000/- and upto Rs. 10,00,00,000/-	Rs.1,12,500 plus 1% of 1/3 of claim amount over and above Rs. 1,00,00,000/-	Rs.1,12,500 plus 1% of 1/3 of claim amount over and above Rs. 1,00,00,000/-	Rs.1,12,500 plus 1% of 1/3 of claim amount over and above Rs. 1,00,00,000/-	Rs.3,37,500 plus 1% of claim amount over and above Rs. 1,00,00,000/-
Above Rs. 10,00,00,000/- and upto Rs. 20,00,00,000/-	Rs.4,12,500 plus 0.75% of 1/3 of claim amount over and above Rs. 10,00,00,000/-	Rs.4,12,500 plus 0.75% of 1/3 of claim amount over and above Rs. 10,00,00,000/-	Rs.4,12,500 plus 0.75% of 1/3 of claim amount over and above Rs. 10,00,00,000/-	Rs.12,37,500 plus 0.75% of 1/3 of claim amount over and above Rs. 10,00,00,000/-
Above Rs. 20,00,00,000/-	Rs.6,62,500 plus 0.50% of 1/3 of claim amount over and above Rs. 20,00,00,000/- with a ceiling of Rs. 10,00,000/-	Rs.6,62,500 plus 0.50% of 1/3 of claim amount over and above Rs. 20,00,00,000/- with a ceiling of Rs. 10,00,000/-	Rs.6,62,500 plus 0.50% of 1/3 of claim amount over and above Rs. 20,00,00,000/- with a ceiling of Rs. 10,00,000/-	Rs.19,87,500 plus 0.50% of claim amount over and above Rs. 20,00,00,000/- with a ceiling of Rs. 30,00,000/-

Note:

1) **In addition to Fees Travelling Allowance/Hotel/DA/Conveyance expenses entitled equivalent to ED of NHPC will be paid to the arbitrators.**
2) **In case of Sole arbitrator Fees as mentioned for single arbitrator + 25% is payable.**
3) **The above fees shall be shared equally by both i.e. NHPC & Contractor.**

Annexure-I

F. No. 11/22/2021-Th.II
Government of India
(Bharat Sarkar)
Ministry of Power
(Vidyut Mantralay)

Shram Shakti Bhawan, Rafi Marg
New Delhi, the 22nd March, 2022

OFFICE MEMORANDUM

Subject: Constitution of Conciliation Committee of Independent Experts for resolution of contractual disputes in respect of the projects implemented by CPSUs / Statutory Bodies under administrative control of Ministry of Power – regarding.

With the approval of Hon'ble Minister of Power and New & Renewable Energy, Ministry of Power, vide OM of even number dated 29.12.2021 (**Annex-I**), introduced a conciliation mechanism for settlement of contractual disputes in contracts of CPSUs / Statutory Bodies under Ministry of Power executing power projects. For this purpose, it was decided to constitute three numbers of Conciliation Committees of Independent Experts (CCIEs).

2. Accordingly, a Notification of even number was issued on 07.01.2022 inviting Expression of Interest from the eligible candidates for empanelment as Independent Expert for constitution of the CCIEs. Consequently, with the approval of Hon'ble Minister of Power, a Search-cum-Selection Committee was also constituted for scrutiny of the EoIs as well as screening of the candidates.

3. Based on the recommendations of the Search-cum-Selection Committee, following three nos. of Conciliation Committee of Independent Experts are hereby constituted for settlement of contractual disputes in contracts of CPSUs / Statutory Bodies under Ministry of Power executing power projects:-

CCIE	Members of CCIE
CCIE-1	Shri Anup Wadhawan, Ex-Secretary (Commerce), GoI
	Shri Ravinder Kumar Sharma, Ex-MD, HBSEBL
	Shri Mrinal Kanti Bhattacharya, Ex-Executive Director, Indian Bank
CCIE-2	Ms. Rashmi Verma, Ex-Secretary (Tourism), GoI
	Shri Dhirendra Veer Singh, Ex-CMD, THDC (India) Ltd.
	Shri Naveen Bhushan Gupta, Ex-Director (Finance), PFC Ltd.
CCIE-3	Shri P. S. Kharola, Ex-Secretary (Civil Aviation), GoI
	Shri Anil Kumar Jha, Ex-Director (Technical), NTPC Ltd.
	Shri Chinmaya Gangopadhyaya, Ex-Director (Projects), PFC Ltd.

4. The aforementioned CCIEs shall function as per the Standard Operating Procedure enumerated in this Ministry's Office Memorandum of even number dated 29.12.2021. Moreover, the tenure, remuneration and other terms and conditions of the engagement of above Members of CCIEs shall also be governed by the aforesaid OM.

This issues with the approval of Hon'ble Minister of Power and New & Renewable Energy.

Encl: as above.

(Vikrant S. Dhillon)
Deputy Director
Email: hydro2-mop@gov.in

To
1. Chairperson, CEA
2. CMDs – PGCIL, REC, PFC, NTPC, NHPC, SJVN, THDC, NEEPCO, POSOCO
3. Chairman - BBMB, DVC
4. Director General – BEE, NPTI, CPRI

Copy to:
1. PS to Hon'ble Minister of Power & NRE
2. APS to Hon'ble MoS for Power
3. Sr. PPS to Secretary (Power)
4. Sr. PPS to AS(SKG) / Sr. PPS to AS&FA / Sr. PPS to AS(VKD)
5. All Joint Secretaries of Ministry of Power
6. All Directors / Deputy Secretaries of Ministry of Power.
7. Members of the CCIEs

Copy also to:
In-charge, NIC Cell, MoP with request to publish the OM on the website of Ministry of Power.

(Vikrant S. Dhillon)
Deputy Director

Annexure-II 406

ANNEXI

. 492180/2022/HYDEL-II SECTION

F. No. 11/22/2021-Th.II
Government of India
(Bharat Sarkar)
Ministry of Power
(Vidyut Mantralay)
Shram Shakti Bhawan, Rafi Marg,
New Delhi, Dated 29th December, 2021

OFFICE MEMORANDUM

Subject: Dispute Resolution through Conciliation for Contractual Disputes in Projects implemented by CPSUs / Statutory Bodies under the administrative control of Ministry of Power – Constitution of Conciliation Committee of Independent Experts (CCIE) – Reg.

CPSUs / Statutory Bodies (Developer) executing power projects, have been raising concerns that the present modalities of dispute resolution are not adequate to expeditiously and effectively address the disputes between the Developer and the Contractors. The delay in resolution of such contractual disputes has been identified as one of the major reasons impacting timely completion of power sector projects. The existing mechanism of dispute resolution through Dispute Resolution Boards or Arbitration Tribunal often takes considerable time, which leads to sub-optimal cash flow for the contractors and in time and cost overrun of the projects.

In this context, a Committee of Board Level Officers of CPSUs was constituted to study the field level issues and the difficulties in resolving the issues. The Committee submitted its report, which was deliberated upon in this Ministry in consultation with Central Electricity Authority and the CPSUs. It was observed that several disputes have been arising under the contracts which are not only involving exorbitant legal costs, but also causing diversion of precious human resources of both parties involved in disputes. Early amicable resolution of these disputes is in the interest of all the stakeholders.

2. After careful consideration, Government of India in the Ministry Power have decided to constitute Conciliation Committees of Independent Experts (CCIE), for settlement of disputes arising in contracts of CPSUs / Statutory Bodies executing power projects. There shall be three CCIEs. Each CCIE shall have three members having high level of integrity and proven track record. The Members shall be appointed from amongst the following categories:-

I. Former Officers of the rank of Secretary / Additional Secretary to the Govt. of India.

II. Sector Experts having substantial domain knowledge of project development and O&M of power projects.

III. Experts in Finance with experience in senior positions of Financial Institutions.

Provided that one of the members in each CCIE should be from the category mentioned at 2(II) above i.e. Sector Expert having substantial domain knowledge of project development and O&M of power projects.

Page 1 of 4

2180/2022/HYDEL-II SECTION

3. **Broad Terms and Conditions:**

3.1 The panel of the Independent Experts shall remain valid for a period of three years from the date of its formation and the validity of panel can be extended but not beyond total tenure of 5 years. Depending on the response from the contesting parties and the work-load, the number of panels may be suitably increased from time to time.

3.2 Each member of CCIE would be paid a sum of Rs. 50,000/- as sitting fee per sitting. In addition, Rs. 5,000/- per sitting will be paid for local transport charges for each day of proceeding. The conciliation proceedings shall be completed in each case through 5 sittings in a period of not more than three months from the date the reference made to the CCIE. In exceptional cases, if any dispute so merits, the time period may be extended at the discretion of Conciliation Committee (with reasons to be recorded in writing), for a further period of three months. In case, a particular dispute requires more than 5 sittings, the same may be held at the discretion of the CCIE but with a cap on payment of fee for 5 sittings only. The local transport charges shall, however, be paid as provided for each day of sitting beyond the 5 sittings. The CCIE shall hold day to day sitting at a suitable place (preferably the headquarter of the Developer or New Delhi) and may hold as many sittings every month as it deems appropriate keeping in view the volume of work. All expenditure incurred on the conciliation proceedings including payment of fees to the Conciliators, office space, logistic, secretarial assistance and other incidental expenses etc. shall be borne by the Developer CPSE/Statutory Body initially. Thereafter it shall be shared equally by both parties on completion of the conciliation process.

3.3. There shall not be any conflict of interest for the members of the CCIE due to their past assignments. Individuals appointed as CCIE members shall submit an undertaking in this regard. It shall be ensured that they have not been engaged for providing any services to any of the parties i.e. either Developer organisation or the Contractor in the last five years.

3.4. The procedure of CCIE shall not be treated as alternate arbitration proceedings where both parties come with Statement of claims/defence, arguments/counter arguments, rejoinders, written submissions etc., aided by their respective lawyers. The forum of CCIE is a conciliation forum, where mutual give and take constitutes the essence, rather than strict legal positions of the parties. Hence, the parties are expected to be brief and to the point before the committee with regard to their respective stance and view the exercise in the spirit of conciliation / settlement.

4. **Standard Operating Procedure**:

4.1 On receipt of a reference from the Contractor for conciliation of dispute, the concerned Head of Project (Developer) shall send a communication within 7 working days thereby inviting the Contractor to depute a team of their representatives to interact with the Contract Department (Developer). The template of the communication is enclosed at Annex, which may be modified as per requirement.

4.2 The Contract Department (Developer) will obtain the details and examine the correspondence of either parties relating to disputes, normally within 30 days. They may hold discussions with the team of Contractor and Head of Project to crystallise the issues; prepare the agenda containing the gist on each dispute and set up suitable meetings in an effort to

resolve the issue internally. The present internal mechanism in the CPSU / Statutory Body may be fully exercised to resolve the issue even before attempting conciliation by CCIE.

4.3 Once a conciliation request has been raised by the contractor, within 30 days the same shall be referred to the CCIE in the event of the matter remaining unresolved internally. The CMD/Board of the Developer may suitable decide an amount involved in the dispute below which it would not go into the exercise of conciliation after weighing the nature and quantum of disputes in the concerned organization.

4.4 The Developer will also be free to suggest the option of resolution of disputes by conciliation in case a dispute has arisen. The contractor may select any one of the three CCIEs after leaving out those CCIEs which are unavailable due to work load or any other reason. A CCIE will normally be considered unavailable if it is handling cases to such an extent that there would be avoidable delay in the event of more cases being taken up by the same CCIE.

4.5 The work of maintaining details of CCIE, its members, work load and allocation of a dispute to CCIE will be entrusted to CEA.

5. The possibility of non-availability of any one of the members of CCIE in any proceedings cannot be ruled out. As such, the Committee comprising the other two members shall be competent to proceed in the matter. The proceedings of the Committee shall not be vitiated if one of the three members of CCIE is not present in the deliberations of the Committee. When the parties sign the settlement agreement, at least two conciliators shall authenticate the same. Such conciliation proceedings shall be considered valid and the settlement agreement will be binding on the parties.

6. In case of any disagreement during execution of contracts, it is expected that the parties will take up the matter first with the Dispute Avoidance Mechanism (through Independent Engineer), wherever the option is available. In case of its failure, the parties may refer the matter further to the Conciliation Committee. The Conciliation process shall be conducted under Part III of the Arbitration and Conciliation Act, 1996. The Conciliation Committee would either be able to resolve and settle and dispute(s) between the parties, or the process may fail. In case of failure of the conciliation process at the level of the Conciliation Committee, the parties may withdraw from conciliation process and take recourse to the laid down legal process of Courts. However, the option of Arbitration would not be available once the conciliation mechanism has been exercised. In the event of the conciliation proceedings being successful, the parties to the dispute would sign the written settlement agreement and the conciliators would authenticate the same. Such settlement agreement would then be binding on the parties in terms of Section 73 of the Arbitration and Conciliation Act, 1996

7. After successful conclusion of proceedings, the Parties to the conciliation process, have to undertake and complete all necessary actions for implementation of the terms of settlement within a period of 30 days from execution of settlement agreement, unless a different timeline not exceeding 60 days is agreed upon in settlement agreement. All pending claims of parties, in connection with the dispute, before any other legal forum are to be withdrawn within the said 30 days in pursuance of the settlement agreement.

8. Once the conciliation process succeeds in reaching a settlement agreement, at the level of the Conciliation Committee, further legal proceedings by the CPSU/ Statutory Body/

. 492180/2022/HYDEL-II SECTION

Autonomous Body under MoP, will be allowed only after obtaining the approval of Ministry of Power.

9. **Procedure in cases already pending before the Arbitral Tribunals / Courts:**

In cases of disputes pending before the Arbitration Tribunals or the Courts, both of the parties [i.e. Developer and Contractor] need to agree to explore the possibilities of conciliation through the Conciliation Committee of Independent Experts. In case of such agreement, an appropriate reference shall be made to the Conciliation Committee, upon which the Committee shall proceed to examine such reference(s). The option of resolution through conciliation through CCIE would be open only in the event of the parties withdrawing from arbitration proceedings and undertaking to forego their rights to proceed for further arbitration in the subject matter. However, other legal remedies would be open to the parties in the event of the conciliation proceedings not being successful.

10. The Conciliation Mechanism shall be available in all the existing and future contracts. Suitable provisions of Conciliation Mechanism shall be incorporated in the contract documents entered into in the future by all CPSUs/Statutory Bodies of Ministry of Power.

11. CCIE is an alternate dispute resolution mechanism being put in the place by the Ministry. If the Contractor is not willing to take recourse to this process or has any reluctance in this behalf, there shall be no compulsion to take such a recourse.

This issues with the approval of Hon'ble Minister of Power and New & Renewable Energy.

(R. P. Pradhan)
Director (Hydel-II)

1. Chairperson, CEA
2. Chairperson, CWC
3. CMDs / Chairman(s) of all the CPSUs / Statutory Bodies / Autonomous Bodies under the Ministry of Power

Copy to:

1. PS to Hon'ble Minister of Power & NRE
2. PS to HMoS for Power
3. Sr. PPS to Secretary (Power)
4. Sr. PPS to AS (SKG) / Sr. PPS to AS (VKD) / Sr. PPS to AS&FA
5. PPS to All Joint Secretaries in Ministry of Power
6. PPS to EA
7. All Directors / Deputy Secretaries / Under Secretaries / Deputy Directors, MoP

492180/2022/HYDEL-II SECTION

Annex

Template Letter to be sent to the Concessionaire/ Contractor/ Consulting party

From:

HOP – concerned Developer
Address .....
.....
.....

To

_____
_____
_____

No. _____ Date: _____

Subject: Your reference dated _____ regarding the Dispute in the project _____ for a meeting at the level of CMD (Developer) and Chairman (Contractor Agency) for settlement.

Sir,

Kindly refer to your above cited reference on the subject cited above. It is agreed to refer the matter for consideration of the CMD, Developer and Chairmen of BOD of the Contractor for settlement of the dispute. However, in order to arrive at any proposed conciliation, it would be useful if the team from the Developer and your Company / firm discuss and crystallise the issues in advance of the proposed meeting.

2. You are, therefore, requested to discuss the issues / disputes with the Developer team led by the Contract Management Division of the Developer on a date mutually convenient.

Yours Sincerely,

(_____)
HOD / General Manager
Concerned Developer

Copy to:

1. CMD, Developer
2. AGM(Project), Developer. It is requested that all correspondence / documents relating to the subject along with index may please be furnished to the Contract Management Division within 7 days of this letter.

Annexure VI

No. 05/0003/2019-FTS-10937
Government of India
Ministry of Finance
Department of Public Enterprises

Public Enterprises Bhawan,
Block No. 14, CGO Complex,
Lodhi Road, New Delhi-110003.

Dated: 14th December, 2022

OFFICE MEMORANDUM

Subject: Settlement of commercial disputes between Central Public Sector Enterprises (CPSEs) *inter* se and CPSE(s) and Government Department(s)/Organization(s) - Administrative Mechanism for Resolution of CPSEs Disputes (AMRCD).

Whereas guidelines for resolution of commercial disputes between Central Public Sector Enterprises (CPSEs) *inter se* and also between CPSEs and Government Departments/Organizations were issued vide DPE OM No. 4(1)/2013-DPE(GM)/FTS-1835 dated 22nd May, 2018 followed by clarification dated 4th July, 2018 and 11th July, 2018. These guidelines were further amended vide DPE OM No. DPE-GM-05/0003/2019-FTS-10937 dated 20.02.2020.

2. And whereas a need has been felt to streamline the existing guidelines with a view to consolidate them and institutionalise a better monitoring mechanism for faster resolution of disputes.

Now therefore the Revised Guidelines (in supersession of the aforesaid notifications/Office Memoranda) shall be as follows: -

3. **Replacement of PMA and Applicability: -**

3.1 Permanent Machinery of Arbitration (PMA) stands wound up from the date of issue of DPE OM dated 22-05-2018. All pending cases with Sole Arbitrator, PMA and Appellate Authority stand transferred to concerned administrative Ministries/Departments.

3.2 A decentralised 'Administrative Mechanism for Resolution of CPSEs Disputes' (AMRCD) having two level (tier) structures shall replace the erstwhile Permanent Machinery of Arbitration (PMA) mechanism of DPE.

3.3 Any dispute or difference relating to the interpretation and application of the provisions of commercial contract(s) between Central Public Sector Enterprises (CPSEs)/ Port Trusts *inter se* and also between CPSEs and Government Departments/Organizations (excluding disputes relating to Railways, Income Tax, Customs & Excise Departments), shall be taken up by either party for its resolution through AMRCD only.

3.4 No appeals are to be made to Cabinet Secretary in such matters, including those in which Sole Arbitrator has passed order before the date of notification of AMRCD, unless the resolution of the disputes has been considered at the level of Administrative Ministry / Department as per procedure prescribed below.

4. Procedure and Structure of Committees: -

4.1 At the First level (tier), the disputes shall be arbitrated upon by a Committee comprising of Secretaries of the Administrative Ministries/Departments to which the disputing CPSEs/Parties belong and Secretary, Department of Legal Affairs. In case the two disputing parties belong to the same Ministry/Department, the above said Committee will comprise Secretary of the Administrative Ministry/Department concerned, Secretary, Department of Legal Affairs and Secretary, Department of Public Enterprises. In case of a dispute between CPSE and State Government Department/Organization, the matter shall be arbitrated through a committee comprising Secretary of the Ministry/Department of the Union to which the CPSE belongs, Secretary- Department of Legal Affairs and a Senior Officer (not below the rank of Secretary in the State Government) nominated by the Chief Secretary of the State concerned.

4.2 In case the dispute remains unresolved even after consideration by the above Committee, the same will be referred through DPE at the Second level (tier) to the Cabinet Secretary whose decision will be final and binding on all concerned.

4.3 At the First level (tier), the claiming party (Claimant) will approach the FA of its administrative Ministry/Department for referring the dispute to the DPE through DPE web-portal. The FA of the administrative Ministry/Department of the claimant after initial scrutiny would intimate DPE through DPE web-portal for notification of the constitution of CoS. This may be done within 30 days of the receipt

of the dispute claim. DPE will notify the constitution of the CoS to all members of CoS and FAs of the concerned administrative Ministry/Department within 15 days of receipt of FA's reference. The meetings of CoS will be organized by FA of claimant party and would be held in the Administrative Ministry / Department of the claiming party to examine the facts and resolve the dispute on merit. The FAs of the concerned Administrative Ministries / Departments will represent the issues related to the dispute in question before the above Committee. After arriving at a decision by the Committee, the Secretary of the administrative Ministry / Department of the claiming party will write down the decision and it will be signed jointly by the two Secretaries and Secretary, Department of Legal Affairs. A copy of the decision will be communicated by the Secretary of the administrative Ministry / Department of the claiming party to each party to the dispute for implementation and also uploaded on DPE web-portal (http://pesurvey.nic.in).

4.4 In case where one party (1st party) to the dispute is a Department /Organization of a State Government, the procedure for admitting the dispute will be the same as above. However, in such cases, all meetings in connection with resolution of the dispute will be held in the Administrative Ministry/Department (Union) of other party (2nd Party) irrespective of the position of the 1st Party whether as a Claimant or Respondent. The presentation of the issues before the above Committee in this case will be done by the FA of the concerned Administrative Ministry/Department and the nominated officer of the State Government Department/Organization.

4.5 The CoS at the first level (tier) shall finalise its decision within three months of the constitution of the Committee by DPE.

5. **Appeal**

5.1 Any party aggrieved with the decision of the Committee at the First level (tier) may prefer an appeal before the Cabinet Secretary at the Second level (tier) within 30 days from the date of receipt of decision of the Committee at First level, through its administrative Ministry/Department on DPE web-portal. The appeal should be in the form of a concise self-contained Note which should invariably include the comments / views of the Opposite Party (Respondent) through its administrative Ministry / Department.

5.2 Appeal in reference to resolution of the dispute as per para 5.1 above is to be made to Cabinet Secretary only after exhausting the channel of dispute resolution at the first level (Ist tier) of the Committee of Secretaries as per procedure prescribed ibid.

5.3 The decision of Cabinet Secretary will be final and binding on all concerned.

6. **Arbitration Clause**

6.1 All CPSEs will ensure inclusion of a clause in all the existing and future commercial contracts between CPSEs, *inter-se* and CPSEs and Government Departments/Organizations as under: -

"In the event of any dispute or difference relating to the interpretation and application of the provisions of commercial contract(s) *between Central Public Sector Enterprises (CPSEs) / Port Trusts inter se and also between CPSEs and Government Departments/Organizations* (excluding disputes relating to Railways, Income Tax, Customs & Excise Departments), *such dispute or difference shall be taken up by either party for its resolution through AMRCD as mentioned in DPE OM No. 05/0003/2019-FTS-10937 dated 14th December, 2022 and the decision of AMRCD on the said dispute will be binding on both the parties."*

6.2 The on-going contracts shall also be suitably amended accordingly.

7. **Review of Progress:-**

7.1 DPE shall be the single point for capturing all details related to AMRCD cases through its web-portal (http://pesurvey.nic.in/). DPE shall also provide secretarial assistance to the Cabinet Secretariat in all matters relate to AMRCD including appeal cases.

7.2 The decision taken by the CoS / Appellate Authority will be implemented by the concerned CPSEs within one month from the date of the decision and action taken would be updated on web portal of DPE.

7.3 A monthly status report of pending cases will be sent to Cabinet Secretariat through DPE web-portal. The FA of the concerned Administrative Ministry / Department of the claimant CPSE will get the position updated by 10th of the following month so that a consolidated report could be sent by 15th of every month to Cabinet Secretariat.

7.4 The administrative Ministry of the claimant CPSEs will also report the delay in disposal of the cases beyond the stipulated three months' time in their monthly DO to Cabinet Secretariat with reasons of delay and the likely extended date for final disposal.

8. All the administrative Ministries / Departments concerned with Central Public Sector Enterprises/ Govt. Organisations / Port Trusts etc. are requested to bring these consolidated guidelines to the notice of all CPSEs/organisations under their administrative control for strict compliance of the above guidelines including adhering to the timelines stipulated therein.

9. This issues with the approval of the Competent Authority.

पवनेश कुमार शर्मा/(Pavanesh Kumar Sharma)
निदेशक/ Director
Tel.:011- 24363066

(i) Secretary of all Ministries / Departments of the Government of India.
(ii) Chief Secretary of all the States and Union Territories.

Copy to:

Chief Executive of all CPSEs for information and necessary compliance.

Copy forwarded for kind information to:

(i) The Prime Minister's Office, South Block, New Delhi.
(ii) The Cabinet Secretariat, Rashtrapati Bhawan, New Delhi.
(iii) PS to the Minister (Finance), Udyog Bhawan, New Delhi.
(iv) Secretary (DPE), CGO Complex, New Delhi
(v) Secretary (Law), Department of Legal Affairs, Shastri Bhawan, New Delhi.

पवनेश कुमार शर्मा/(Pavanesh Kumar Sharma)
निदेशक/ Director
Tel.:011- 24363066

VOLUME 2

PART B:
SPECIAL CONDITIONS OF CONTRACTS (SCC)

SPECIAL CONDITIONS OF CONTRACT (SCC)

1. POWER EVACUATION & CONNECTIVITY

GSECL has secured connectivity and LTA from CTU for Khavda Solar Park.

Obtaining connectivity and fulfilment of all the obligations for FTC approval as per connectivity regulation & prescribed procedure by WRLDC/CEA/CERC/CTU/PGCIL/ RLDC/Grid India or any other authorities, for the project (including timely submission of all the required documents for the same) shall be the responsibility of bidder and shall be at the cost of the Contractor.

All the necessary compliance at 33 kV level, i.e. Study Reports/ Models, additional equipment for reactive power support etc as required by the WRLDC shall be in the scope of Contractor. Any non-compliance and delay in FTC shall be at the cost & risk of Contractor.

The regulations on "Technical Standards for Grid Connectivity" (and subsequent amendments) may be strictly adhered to maintain grid security and the report namely "Data Submission Procedure and Verification of Compliance to CEA Regulations on Technical Standards for Connectivity to the Grid by RE Generators" may also be referred to for this purpose.

All the commissioning related inspections, drawings, tests, approvals and evacuation of power as per scheme approved /connectivity approval shall be responsibility of EPC contractor.

2. PROCUREMENT OF STATUTORY CLEARANCES, PERMIT, REGULATORY CLEARANCES ETC AND FACILITATIONS/ COMPLIANCES THEREOF:

The contractor is solely responsible for obtaining all permits & statutory clearances including those required from State/Central Government and local bodies required for setting up of the Project and operation of the Plant including liasioning for the purpose.

The contractor shall comply with all applicable laws or ordinances, codes, approved standards, rules, and regulations and shall arrange all necessary Panchayat/Municipal and Government permits & licenses etc. at his own cost. “Permit” shall mean any and all formal clearances, licenses, authorizations, consents, decrees, waivers, privileges, approval of filings, of or required by any Governmental Instrumentality in connection with the development, establishment, construction, maintenance, operation, ownership of the Project. Assistance wherever required shall be provided by Owner.

All the statutory fees/ charges deposited, licenses/permits, clearances, permissions, certificates, approvals, registration, connections etc obtained etc. should be in the name of NHPC Ltd.

The contractor shall ensure that compliances under tax law e.g. proper documentation in respect of transit sales, issue of proper LR, way bill & invoices etc. by the concerned subcontract/ sub vendor mentioning TIN number of the contractor and not of NHPC Limited.

3. QUALITY ASSURANCE PLAN (QAP) & INSPECTION:

All correspondences related to Quality assurance; Inspection & testing shall be made to:

Executive Director
Quality Assurance & Inspection Division (QA&I Division)
NHPC Ltd, Sector- 33
Faridabad (Haryana)-121003

Quality Assurance and Testing Plan:

Detail shall be submitted within 15 days after award of contract for the Approval of Employer.

Pre-dispatch inspection & Dispatch Clearance:

The equipment shall be inspected by an authorized representative of QA&I Division, NHPC Corporate Office at Manufacturer's/Supplier's premises before dispatch as per QAP (Quality Assurance Plan) of manufacturing, approved by NHPC QA&I Division. The Materials/Equipment/Items shall only be dispatched after issue of Material Dispatch Clearance Certificate (MDCC)

4. SAFETY STANDARDS

The Contractor shall ensure safety related aspects during Construction and O&M as per applicable laws and industry practice.

5. AVAILING CARBON CREDIT

Employer may get the project registered under CDM. Employer will take care of the CDM related formalities. The Contractor shall provide all the required information / data, at no extra cost, to Employer as may be asked for fulfilling the requirements of Clean Development Mechanism (CDM). This would include, but not limited to, assistance during the local stakeholder consultation meeting, providing information regarding monitoring of the project, maintaining log books for different parameters like generation, plant shutdown, grid availability, etc. regular calibration of the meters as per applicable grid code and any other information that is required by the validator during the CDM validation of the project.

6. IMPLEMENTATION/ DELIVERY SCHEDULE

Delivery schedule of material & implementation schedule of project activities is prepared and is attached as **Annex-1**. The schedule indicates the activities from placing of purchase order to receipt of material at site. The bidders are required to stick to the delivery schedule for smooth execution of project.

7. GST LIABILITY ON LIQUIDATED DAMAGES

DELETED.

8. TESTING OF POWER SUPPLY SYSTEM AND NETWORK

In order to protect the security, integrity and reliability of the strategically important and critical power supply system & network from cyber-attacks through malware / trozens etc. embedded in imported equipment:

a) All equipment, components, and parts imported for use in Power Supply System and Network shall be tested in the country to check for any kind of embedded malware / Trojans / cyber threat and for adherence to Indian standards.

b) All such testing shall be done in certified laboratories that will be designated by the Ministry of Power (MOP).

c) Any import of equipment / components / parts from “prior reference” countries, as specified or by persons owned by, controlled by, or subject to the jurisdiction or the direction of these prior reference countries will require prior permission of the Government of India.

d) Where the equipment / components / parts are imported from prior reference countries with special permission, the protocol for testing in certified and designated laboratories shall be approved by the Ministry of Power (MOP).

Any cost implication on account of above shall be borne by the contractor.

9. AMC OF CRITICAL EQUIPMENT FOR STIPULATED DURATION BEYOND O&M PERIOD

The Contractor shall furnish undertaking jointly executed by itself and its vendor for Annual Maintenance Contract of critical equipment for stipulated duration beyond O&M period as specified below.

Equipment/ System	**Comprehensive AMC** (Start from date of commissioning of full capacity.)
Inverter /PCU	10 Years
SCADA	10 Years
PPC	10 Years
Tracker	10 Years
Robotic Cleaning System	10 Years

Proforma for the Joint Undertaking for AMC of critical Equipment for Stipulated Duration Beyond O&M Period for Invertor/SCADA/PPC/ Dry cleaning system/ tracker system is enclosed as **Annex-2**. Contractor to note that separate Joint undertaking is required to be furnished for aforesaid equipment. The Joint Undertaking shall be submitted 60 days before completion of O&M Contract.

Contractor shall carry out regular predictive maintenance during entire AMC period through OEM or OEM authorized service provider. The AMC document has to be submitted before commissioning of full capacity. The AMC shall be part of Comprehensive O&M Contract

10. BANK GUARANTEE FOR SHORTFALL IN GENERATION IN O&M PERIOD, AMC OF THE EQUIPMENT & OTHER OBLIGATIONS SPECIFIED ELSEWHERE IN THE CONTRACT DURING O&M AND AMC PERIOD.

The Contractor shall, at least 15 days prior to the commissioning of the part or full project capacity shall furnish a security in form of Bank Guarantee to take care of Shortfall in generation during O&M Period, AMC of equipment and other obligations specified elsewhere in the contract during O&M and AMC period as below. This BG shall be in

addition to Performance security to be provided by the contractor for due performance of Contract as per GCC.

(a) BG for generation shortfall in O&M, AMC etc = 0.1 x G x R (in million INR) up to 5-year O&M period Where G is Annual Quoted Generation quoted by bidder in MU and R is the applicable Tariff@ INR 2.73/kWh. The validity of BG shall be up to 60 days beyond the Comprehensive O&M period of Contract (i.e. till 05 years from commissioning of full capacity of project).

(b) During the O&M period of Contract, if the security or part thereof is encashed due to shortfall in generation, the contractors shall, within three (03) months, enhance the security to the value specified at (a) above.

(c) Beyond 5th year from commissioning of full project capacity (i.e. from 6th year till end of 10th year), the Contractor shall further extend the above security for a further period of 5 years i.e. the validity shall be extended till 90 days beyond the ten (10) years from commissioning of full project capacity to cover comprehensive AMC of equipment and the value of the security shall be revised as per the following:

I. BG amount is revised to 1.0 Lakh/MW to cover comprehensive AMC of Inverter, SCADA & PPC
II. In case, bidder proposes tracker-based system, additional BG amount of 0.25 Lakhs/MW to cover comprehensive AMC of tracker system shall be included with Sl no (I).
III. In case bidder proposes robotic dry-cleaning system, additional BG amount of 0.25 Lakhs/MW to cover comprehensive AMC of robotic cleaning system shall be included with Sl no (I)

(d) The above securities will be returned to the contractor without any interest at the expiration of the security at the end of 10 years of commissioning of full project capacity."

11. PV MODULE PERFORMANCE INSURANCE

To ensure faithful performance of PV modules, Bidder must submit PV Module Insurance with a coverage of minimum 6 % of total order value of the module supplies envisaged under the contract for 25 years, with the employer as its beneficiary. Any financial implication encountered due to insurance shall be borne by the bidder. The following clauses are to be complied:

1) The insurance has to be issued from one of the companies as listed below:

a. Swiss RE

b. Munich RE

c. Power Guard

d. Ariel Re

In case of domestic manufacturers, insurance from the aforementioned insurers to be provided through any agency in MNRE approved list, issued vide OM Dated 07.01.2020

2) In case of insolvency of the contractor, the Employer under the terms of the insurance policy against Module Performance and Warranty shall be entitled to raise a claim against the Module Warranty Insurance Policy and in order to benefit from the coverage provided by the aforementioned policy. The Contractor shall be responsible for maintaining the coverage provided under the Module Warranty Insurance Policy at all times, at its cost and expense.

3) Further, the Contractor to note that Employer requires the following to be complied while covering the Warranty/Guarantee/Performance of the supplied goods under the insurance:

a) Single Insurance Policy for Product Warranty/Guarantee and performance before dispatch of the first lot of PV Modules Insurance.

b) The Insurance Policy shall be valid for a minimum period of twenty-five (25) years from the date of receipt of last batch/lot of equipment at site.

c) The premium charges, recurring charges, any other expenditure under the Insurance Policy shall be covered by the Contractor.

d) The insurer must continue to compensate end users for warranty claims for the product quality and/or performance even if contractor ceases to exist as an independent operating company.

e) The insurance shall be non-cancellable by the insurer and shall provide third party bankruptcy rights.

f) Coverage under the insurance policy shall be immediate, without any waiting period.

12. PV MODULE PERFORMANCE INSURANCE POLICY

EPC Contractor shall be obligated to submit “PV Module Performance Insurance Policy” before raising Invoice/RA Bill for the supply of Solar PV Modules, otherwise the same shall not be considered for payment till compliance on the above is ensured.

13. PROCUREMENT FROM COUNTRIES SHARING LAND BORDER WITH INDIA:

a. Any bidder from a country which shares a land border with India (except to which the Government of India has extended line of credit or in which the Government of India is engaged in development projects as mentioned in Order Public Procurement No. 2 dt. 23.07.2020 or its subsequent revisions/amendments) will be eligible to bid only if the bidder is registered with the Competent Authority, i.e. Registration Committee constituted by DPIIT.

b. The successful bidder shall not be allowed to sub contract works to any contractor from a country which shares a land border with India (except to which the Government of India has extended line of credit or in which the Government of India is engaged in development projects as mentioned in Order Public Procurement No. 2 dt. 23.07.2020 or its subsequent revisions/amendments) unless such contractor is registered with the Competent Authority, i.e. Registration Committee constituted by DPIIT.

c. A bidder is permitted to procure raw material, components, sub assemblies,

etc. from the vendors of countries sharing a land border with India without getting registered with the Competent Authority, i.e. Registration Committee constituted by DPIIT, as it is not regarded as “sub contracting”.

d. However, in case a bidder proposes to supply finished goods procured directly/indirectly from the vendors of the countries sharing land border with India, such vendors will be required to get registered with the Competent Authority, i.e. Registration Committee constituted by DPIIT.

Procurement of spare parts and other essential service support like Annual Maintenance Contract (AMC) / Comprehensive Maintenance Contract (CMC), including consumables for closed systems, from Original Equipment Manufacturers (OEMs) or their authroised agents, shall be exempted from the requirement of registration as mandated under Rule 144(xi) of GFRs 2017.

14. PUBLIC PROCUREMENT (PREFERENCE TO MAKE IN INDIA) ORDER:

Definitions:

Local Content: means the amount of value added in India which shall, unless otherwise prescribed by the Nodal Ministry, be the total value of the item procured (excluding net domestic indirect taxes) minus the value of imported content in the item (including all custom duties) as a proportion of the total value, in percent.

In case of items having sufficient local capacity and local competition, local content equal to or more than 50% shall be allowed only. The list of items having sufficient local capacity and local competition shall be as per Ministry of New & Renewable Energy order no. F. No. 283/22/2019-GRID SOLAR dated 23.09.2020 and its further revisions.

Class-I local supplier: means a supplier or service provider, whose Goods/ services/ Works offered for procurement, has local content equal to or more than 50%.

Class-II local supplier: means a supplier or service provider, whose Goods/ services/ Works offered for procurement, has local content equal to or more than 20% but less than 50%

Non Local Supplier: means a supplier or service provider, whose Goods/ services/ Works offered for procurement, has local content equal to or less than 20%.

Margin of purchase preference: means the maximum extent to which the price quoted by a ‘Class-1 local supplier’ may be above the L-1 for availing purchase preference. The margin of purchase preference shall be 20%.

Works: means all works as per Rule 130 of GFR-2017, and shall also include Turnkey works, Engineering, Procurement & Construction (EPC) Contracts and Services include System Integrator (SI) contracts.

Eligibility Criteria for Class I / II and Non Local Suppliers.

a) For procurement of Goods/Services/Works, irrespective of purchase value where there is sufficient local capacity and local competition, only Class-I local supplier shall

be eligible to bid.

b) For procurement of Goods/Services/Works, not covered under a) above and having estimated value less than INR 200.00 Crore, Global tender enquiry shall not to be issued except with the approval of Competent Authority as designated by Department of Expenditure. Only Class-I and Class-II local suppliers shall be eligible to bid in procurements, except when Global tender enquiry has been issued. In Global tender enquiries, Non-local suppliers shall also be eligible to bid alongwith Class-I and Class-II local suppliers.

The above criteria shall be subject to compliance of following:

i) The bidder shall have to be an entity registered in India in accordance with law. Indian subsidiaries of foreign bidders are eligible to participate in the bidding process provided they meet the qualifying criteria in terms of capability, competency, financial position, past performance etc. Further, Foreign bidders shall compulsorily set up their manufacturing units on a long term basis in India.

ii) Foreign bidders can also participate in the bidding process provided they form Joint Venture with any bidder registered in India in accordance with law.

iii) Country of origin of the equipment/material shall be provided in the bid.

iv) The bids shall be in Indian National Rupees (INR) only in respect of local content.

v) The bidder shall follow Indian laws, regulations and standards.

vi) For supply of equipment / material from the country of origin other than India, the bidder shall submit performance certificate in support of satisfactory operation in India or a country other than the country of origin having climatic and operational conditions including ambient temperature similar to that of India for minimum one year.

vii) The manufacturer/ supplier shall list out the products and components producing Toxic E-waste and other waste. It shall have an Extended Producers Responsibility (EPR) so that after the completion of the lifecycle, the materials are safely recycled / disposed of by the Manufacturer/ Supplier and for this, the Manufacturer/Supplier along with procurer has to establish recycling / disposal unit or as may be specified.

viii) The bidder shall have to furnish a certificate regarding cyber security/safety of the equipment / process to be supplied/services to be rendered as safe to connect.

ix) Wherever required, the Foreign supplier shall establish fully functional service centres in India and shall keep spares/material locally for future needs of Utilities.

x) Arbitration proceedings shall be instituted in India only and all disputes shall be settled as per applicable Indian Laws.

Procedure for Purchase Preference**:**

a) Subject to the provisions of this Order and to any specific instructions issued by the Nodal Ministry or in pursuance of this Order, purchase preference shall be given to “Class-I local supplier” only in procurement undertaken by procuring entities in the manner specified here under.

b) In the case of procurement of goods / works, which are divisible in nature, the 'Class-I local supplier' shall get purchase preference over 'Class-II local supplier' as well as 'Non-local supplier', as per following procedure(not applicable in this tender):

(i) Among all qualified bids, the lowest bid will be termed as L1. If L1 is 'Class-I local supplier', the contract for full quantity will be awarded to L1.

(ii) If L1 bid is not a 'Class-I local supplier’, 50% of the order quantity shall be awarded to L1. Thereafter, the lowest bidder among the 'Class-I local supplier' will be invited to match the L1 price for the remaining 50% quantity subject to the Class-I local supplier's quoted price falling within the margin of purchase preference, and contract for that quantity shall be awarded to such 'Class-I local supplier' subject to matching the L1 price. In case such lowest eligible 'Class-I local supplier' fails to match the L1 price or accepts less than the offered quantity, the next higher 'Class-I local supplier' within the margin of purchase preference shall be invited to match the L1 price for remaining quantity and so on, and contract shall be awarded accordingly. In case some quantity is still left uncovered by Class-I local suppliers, then such balance quantity shall be ordered to the L1 bidder.

c) For procurement of goods / works, which are not divisible in nature, and in procurement of services where the bid is evaluated on price alone, the 'Class-I local supplier' shall get purchase preference over 'Class-II local supplier' as well as 'Non-local supplier', as per following procedure(applicable for this tender):

(i) Among all qualified bids, the lowest bid will be termed as L1. If L1 is 'Class-I local supplier', the contract will be awarded to L1.

(ii) If L1 is not 'Class-I local supplier', the lowest bidder among the 'Class-I local supplier', will be invited to match the L1 price subject to Class-I local supplier's quoted price falling within the margin of purchase preference, and the contract shall be awarded to such 'Class-I local supplier' subject to matching the L1 price.

(iii) In case such lowest eligible 'Class-I local supplier' fails to match the L1 price, the 'Class-I local supplier' with the next higher bid within the margin of purchase preference shall be invited to match the L1 price and so on and contract shall be awarded accordingly. In case, none of the 'Class-I local supplier' within the margin of purchase preference matches the L1price, the contract may be awarded to the L1 bidder.

(d)"Class-II local supplier" and "Non-local supplier" will not get purchase preference in any procurement, undertaken by procuring entities.

Verification of local content:

(a) The 'Class-I local supplier'/ 'Class-II local supplier' at the time of tender, bidding or solicitation shall be required to indicate percentage of local content and provide self-certification that the item offered meets the local content requirement for 'Class- I local supplier'/ 'Class-II local supplier', as the case may be. They shall also give details of the location(s) at which the local value addition is made.

(b) In cases of procurement for a value in excess of INR 10.00 Crores, the 'Class-I local supplier'/ 'Class-II local supplier' shall be required to provide a certificate from the statutory auditor or cost auditor of the company (in the case of companies) or from a practicing cost accountant or practicing chartered accountant (in respect of suppliers other than companies) giving the percentage of local content.

(c) Decision on complaints relating to implementation of this order shall be taken by the competent authority which is empowered to look in procurement related complaints relating to the procuring entity.

(d) Nodal Ministries may constitute committees with internal and external experts for independent verification of self declarations and auditors / accountants certificate on random basis and in the case of complaints.

(e) Nodal Ministries and procuring entities may prescribe fees for such complaints.

(f) False declarations will be in breach of the Integrity Pact for which a bidder or its successors can be debarred for up to two years along with such other actions as may be permissible under law. A supplier who has been debarred by any procuring entity for violation of this Order shall not be eligible for preference under this Order for procurement by any other procuring entity for the duration of the debarment. The debarment for such other procuring entities shall take effect prospectively from the date on which it comes to the notice of other procurement entities.

Reciprocity Clause

(i) When a Nodal Ministry / department identifies that Indian suppliers of an items are not allowed to participate and / or compete in procurement by any foreign government, due to restrictive tender conditions which have direct / indirect effect of barring Indian companies such as registration in the procuring country , execution of project of specific value in the procuring county etc., it shall provide such details to all its procuring entities including CMDs / CEOs of PSEs / PSUs, State Government and other procurement agencies under their administrative control and GeM for appropriate reciprocal action.

(ii) Entities of countries which have been identified by the nodal ministry / department as not allowing Indian companies to participate in their Government procurement for any item related to that Nodal Ministry shall not be allowed to participate in Government procurement in India for all items related to that Nodal Ministry / Department, except for the list of items published by the Ministry / Department permitting their participation.

NOTE:

NHPC is intending to get exemption from concerned authorities for 'omission of provision of local content requirements for Solar modules and Inverters regarding Public Procurement (Preference to Make in India) for Purchase Preference.' Bidders are advised to quote their bids considering omission of provision of Local content requirements for Solar Modules and Inverters regarding Public Procurement (Preference to Make in India) for Purchase Preference. However, award of works shall be done only after grant of aforesaid exemption.

15. PLANNING AND DESIGNING IN PURVIEW OF VULNERABILITY ATLAS OF INDIA:

Vulnerability Atlas of India is a comprehensive document which provides existing hazard scenario for the entire country and presents the digitized State/ UT-wise hazard, maps with respect to earthquakes, winds and floods for district wise identification of vulnerable areas. It also includes additional digitized maps for thunderstorms, cyclones and landslides. The main purpose of this atlas is its use for disaster preparedness and mitigation at policy planning and project formulation stage.

This atlas is one of its kind single point source for various stake holders including policy makers, administrators, municipal commissioners, urban managers, engineers, architects, planners, public etc. to ascertain proneness of any city/location/site to multi-hazard which includes earthquakes, winds, floods, thunderstorms, cyclones and landslides. While project formulation, approvals and implementation of various housing, building and infrastructure schemes, this atlas provides for necessary information for risk analysis and hazard assessment.

The Vulnerability Atlas of India has been prepared by Building Materials and Technology Promotion Council under Ministry of Housing and Urban Affairs, Government of India and available at their website www.bmtpc.org.

It is mandatory for the bidders to refer Vulnerability Atlas of India for multi-hazard risk assessment and include the relevant hazard proneness specific to project location while planning and designing the project in terms of

i) Seismic Zone (II to V) for earthquakes)
ii) Wind Velocity (Basic Wind Velocity 55, 50, 47, 44, 39 & 33 m/s)
iii) Area liable to floods and Probable max. Surge height
iv) Thunderstorms history
v) Number of cyclonic storms/ severe cyclonic storms and max sustained wind specific to coastal region.
vi) Landslides incidences and Annual rainfall normal
vii) District wise Probable Max. Precipitation.

16. CYBER SECURITY FOR POWER SYSTEM EQUIPMENTS:

Ministry of Power (Government of India) has issued Circular no. No.25-l l/6/2018-PG Dated 02.07.2020 on the vulnerabilities in the Power Supply System & Network mainly arise out of the possibilities of cyber attacks through malware / Trojans etc. embedded in imported equipment & Circular No. 12/34/2020-T&R dated 08.06.2021 on Testing power system equipment for use in the Supply System and

Network in the country for Cyber Security. Bidders are advised in their own interest to follow these guidelines and circular issued by the Ministry from time to time.

In order to protect the security, integrity and reliability of the strategically important and critical power supply system & network from cyber-attacks through malware / trozens etc. embedded in imported equipments:

a. All equipments, components, and parts imported for use in Power Supply System and Network shall be tested in the country to check for any kind of embedded malware / Trojans / cyber threat and for adherence to Indian standards.
b. All such testing shall be done in certified laboratories that will be designated by the Ministry of Power (MOP).
c. Any import of equipment / components / parts from “prior reference” countries, as specified or by persons owned by, controlled by, or subject to the jurisdiction or the direction of these prior reference countries will require prior permission of the Government of India.
d. Where the equipment / components / parts are imported from prior reference countries with special permission, the protocol for testing in certified and designated laboratories shall be approved by the Ministry of Power (MOP).

Any cost implication on account of above shall be borne by the contractor. Bidder shall submit the Self-Certificate for Cyber Security as per Attachment-13.

ANNEXURE-1

TENTATIVE DELIVERY SCHEDULE OF MATERIAL & IMPLEMENTATION SCHEDULE OF PROJECT ACTIVITIES FOR 200 MW SOLAR POWER PROJECT AT KHAVDA GUJARAT

S.No.	Delivery/Activity Milestone	1st Month	2nd Month	3rd Month	4th Month	5th Month	6th Month	7th Month	8th Month	9th Month	10th Month	11th Month	12th Month	13th Month	14th Month	15th Month
1	Issue of LOA	Signing of Contract Agreement, Kick off meeting and preliminary discussions on Project Layout & Mobilisation for Site														
General Work																
2	Site Mobilisation, Site Office Opening & Preparatory works															
3	Site Investigations															
4	**Basic Engineering & Approvals** Solar plant Layout Single Line Diagram (DC & AC Both) MMS-Structure and foundation design Data sheet - Modules, Inverters and transformers Foundation drawings - MCR, IDT, Switchgear and Inverter rooms Basic Engineering & Approvals of layout, structure & foundation drawing of Switchyard & Overhead HT Transmission Line work related to E&M and Civil Works (Not applicable in this package)															
5	Detailed Engineering & Approvals															
6	Ordering of Equipments															
Solar Plant Works - DC Side																
7	Supply of MMS															
8	MMS Foundation															
9	Installation of Module Mounting Structures															
10	Supply of SPV Modules															
11	Installation of SPV Modules															
12	Supply of DC Cables															
13	Laying of DC Cables															
Solar Plant Works - AC Side																
14	Supply of AC cables, inverter transformer and inverters & other electrical equipment															
15	Installation of AC cables, inverter transformer and inverters & other electrical equipment															
16	MCR - Civil and Electrical works															
17	Inverter Room - Civil & Electrical works															
18	Fencing, Road and Drainage works and other civil works															
19	. Testing of Equipment and Readiness of SCADA															
Pooling/ Sub pooling Switchgear Work																
20	All Civil works required for interfacing with grid and evacuation of power															
21	Supply of 33kV pooling switchgear and other equipment required for interfacing with grid															
22	Installation of equipment															
23	All associated cable laying, jointing and Civil & Electrical Works required for Inter-connection/ interfacing of 33kV feeders of SPV Project with GSECL 33kV PSS															
Commissioning																
24	Trial Run of Plant & Commissioning															

Annex-2

PROFORMA FOR JOINT UNDERTAKING FOR AMC OF CRITICAL EQUIPMENT FOR STIPULATED DURATION BEYOND O&M PERIOD

(On non-judicial stamp paper of appropriate value)

In consideration of the NHPC Limited, (hereinafter referred to as the 'Employer', which expression shall unless repugnant to the context or meaning thereof include its successors, administrators and assigns) having awarded to M/s. ..... 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 Employer's Notification of Award No. ..... dated ..... and the same having been unequivocally accepted by the Contractor resulting in a 'Contract' bearing No. ..... dated..... valued at..... for..... (Scope of Contract)..... and the Contractor for providing Annual Maintenance Contract (AMC) of Critical Equipment for Stipulated Duration beyond O&M Period as specified in the Bidding Documents. Contractor further agrees to the bidding document that the AMC of Inverter*/SCADA*/PPC System*/Dry Cleaning System*/Tracker* shall be carried out through its vendor M/s…….with its Registered/Head Office at..... (hereinafter referred to as the 'OEM', which expression shall unless repugnant to the context or meaning thereof, include its successors, administrators, executors and assigns). Contractor and OEM shall be jointly and severely liable to undertake the responsibility outlined in bidding document.

IN WITNESS WHEREOF, the ‘Contractor’ and the ‘OEM’, through their authorized representative, have executed these presents on the Day, Month and Year first mentioned above at ..... (Name of the Place) .....

For and on behalf of	For and on behalf of
.....	…….
(Contractor's Name)	(OEM’s name)
Signature	Signature .....
Name	Name .....
Designation of	Designation of …..
Authorised representative	Authorised representative
WITNESS :	**WITNESS :**
1. Signature	1. Signature .....
2. Name	2. Name .....
3. Address	3. Address .....

* Please strike off whichever not applicable. Separate Joint undertaking is required to be furnished for aforesaid equipment.

EMPLOYER'S REQUIREMENT

(TECHNICAL REQUIREMENT)

ELECTRO-MECHANICAL WORKS

PART-1: GENERAL TECHNICAL SPECIFICATIONS

CONTENTS

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1 GENERAL REQUIREMENTS

1.1 General

The Contractor shall strictly observe this General Technical Specification (GTS) in conjunction with the Particular Technical Specifications (PTS). He shall carry out all work in a skilled and workman like manner in compliance with modern methods of engineering. All design, calculations, materials, works, manufacturing and testing shall conform to the latest applicable standards.

In addition, the Contractor shall abide to all applicable regulations regarding the execution of construction and installation work, and shall follow all instructions issued by the competent authorities, and the Engineer in-Charge.

The particular technical specifications shall take precedence over the general technical specifications in case of any contradiction. Clause number cross-references refer to the volume in which they occur unless stated otherwise.

1.2 Scope of Work

The scope of work in this Contract covered by the Electrical-Mechanical Works i.e. Establishment of 200MW (AC) grid connected Solar PV Power Project as Single EPC Package, in 600 MW Solar Park of GSECL (Stage-1) at Khavda, under domestic competitive bidding followed by e-Reverse Auction (e-RA).

The scope also includes five (05) years of Comprehensive Operation and Maintenance (O&M) of the solar PV plant as well as Annual Maintenance Contract (AMC) of critical equipment for a period of ten (10) years.

The Contractor shall prepare the detailed design, construction and installation drawings as well as calculations, material specifications, operating and maintenance instructions, etc. for the works as stipulated in the Particular Technical Specifications.

These Specifications include the performance of all works and the provision of all labours, materials, permanent and temporary equipment, tools, accessories for transport to the site, including loading, unloading, if necessary reloading at the port of arrival, intermediate storage, protection of the works from the effects of the weather, cleaning, drying, storage at site and preservation related works, complete installation, painting, testing and commissioning of all works and accessories of the works.

Comprehensive Operation & Maintenance of the plant shall be performed by the contractor for a period of five years from the date of successful Commissioning of the plant including scheduling and forecasting for generation from the Plant.

The Contractor shall make competent and experienced staff available for the training and assistance of the operating staff during commissioning.

The Contractor shall supply the O&M Instruction Manuals in a number and at a time as stated in the General/ Special Conditions of Contract or elsewhere in bid document.

1.3 Standards

Although European or IEC standards for design, testing, workmanship, material and Works have been mostly selected in these specifications as a basis of reference, other standards and recommendations of standard international

organizations will be acceptable provided they ensure equal or higher quality than those specified, and provided, furthermore, that the Contractor submits for approval, detailed standards which he proposes to use.

When IEC or ISO recommendations or other Standards are referred to, the edition shall be that current at the time of issue of Tender Documents, together with any amendments issued to that date.

If requested by the Engineer in-Charge the Contractor shall supply at his own expense three copies in English and one in the original language of any national standards, which are applicable to the Contract.

Standard publications issued by the following organizations of standardization are considered being approved standards for the works:

1.3.1 Standards for General Application

i)	ISO	International Standards Organisation
ii)	IEC	International Electro technical Commission
iii)	IEEE	Institute of Electrical and Electronic Engineers
iv)	IS	Indian Standards
v)	AISI	American Iron and Steel Institute
vi)	ANSI	American National Standards Institute
vii)	ASME	American Society of Mechanical Engineers
viii)	ASTM	American Society for Testing and Materials
ix)	AWS	American Welding Society
x)	BS	British Standards
xi)	IIW	International Institute of Welding

Notwithstanding reference made to various standards all equipment and works as per provisions and requirements of relevant and latest Indian Standards shall be acceptable.

1.3.2 Material Standards

Materials shall be new and of first-class quality, suitable for the purpose, free from defects and imperfections, and the classifications and grades in conformance with the latest issue of the respective relevant standard. Material to other standards may be used if approval by the Engineer in-Charge has been obtained. Material specifications, including grade or class data, shall be shown on the appropriate detail drawings submitted for review/information/approval.

If using stock material not specifically prepared for the works under this Contract, the Contractor shall submit evidence that the material complies with approved standards and that the material is adequate for the intended use.

The Contractor shall indicate in the Technical Data Schedules, the materials and applicable standards for all major parts of the supply.

The materials shall be carefully selected for the intended purpose and due consideration of the site conditions and the tropical environment. Higher-grade material shall be used where ordinary material is insufficient.

1.3.3 Electrical Standards

The following basic standards for electrical works or any other approved standard shall be applied:

i) IS (Indian Standards)

ii) Standards issued by IEC (International Electro technical Commission)
iii) IEEE (Institute of Electrical and Electronic Engineers)

For specific standards see the Particular Technical Specifications.

1.4 Units of Measurements

The international SI-system of units shall be used for documents, calculations, correspondence, drawings, etc., relevant to the Tender and the subsequent Contract.

1.5 Works Identification System

An approved, uniform Works identification system shall be applied for all mechanical, electrical and Instrumentation and Control (I&C) Works to be agreed upon during detailed design.

1.6 Time Schedule

According to the relevant articles in the General and Special Conditions of Contract, the progress of the work shall conform to the basic Programme of Work on which the Contract is based. The "Programme" to be submitted shall include but not limited to the following information.

i) Design work
ii) Shop work
iii) Testing and inspection of works
iv) Transport to Site
v) Storage at site
vi) Preparations at Site
vii) Interdependence with work of other Contractors
viii) Erection and Commissioning
ix) Acceptance testing
x) Handing over
xi) Removal of erection equipment and clearing of the Site
xii) Operation & Maintenance of the Park & plant

2 TECHNICAL DOCUMENTS

2.1 General

This Chapter specifies the general scope and gives a definition of the standard drawings/documents of various equipments which along with those listed in the Particular Specifications, shall be delivered by the Contractor to the Engineer in-Charge within the periods, and in a number and quality as specified in the General and Special Conditions.

The Engineer in-Charge reserves the right to request the Contractor for additional drawings/documents as may be required for proper understanding and definition of constructional, operational, co-ordination or other matters.

All documents shall be submitted in accordance with the agreed programme during detail engineering so that any comment and change requested by the Engineer in-Charge can be taken into account before starting of the manufacture of the equipment in the workshop and/or erection or installation at the Site.

If the Contractor fails to submit such documents, then the later execution of changes requested by the Engineer in-Charge and the resulting additional cost and/or delays shall be the Contractor's responsibility. The Contractor shall not be absolved of his responsibility and guarantee even after drawings and computations have been approved by the Engineer in-Charge.

On drawings, catalogue sheets or pamphlets of standard Works submitted to the Engineer in-Charge, the applicable types, paragraphs, data, etc. shall either be marked distinctively or the non-applicable parts shall be crossed out. Documents not marked in such a manner will not be accepted and approved by the Engineer in-Charge.

If required for proper understanding of the documents, additional descriptions/explanations shall be given on these documents or on separate sheets. All symbols, marks, abbreviations, etc., appearing on any document shall clearly be explained by a legend on the same document or on an attached sheet.

Each device appearing on any document (drawing, diagram, list, etc.) shall clearly be designated. The abbreviation mark used for an individual device shall be identical throughout the complete documentation so as to avoid confusion. All documents shall have a uniform title-block and agreed by the Engineer in-Charge. Beginning with the very first submittal to the Engineer in-Charge, the Contractor's drawings shall bear a serial number corresponding to a drawing classification plan to be agreed upon by the Contractor and the Engineer in-Charge.

2.2 Drawings

2.2.1 Foundation Drawings

If a piece of Works requires its own foundation or needs a special area for installation, the Contractor shall submit drawings indicating all pertinent dimensions, static and dynamic loads, etc. They shall include all essential details required for proper design and construction of the foundations and/or buildings.

In addition, these shall include openings, sleeves, slopes and the arrangement of any supporting structure, i.e. base-frames or other steel constructions for permanent fixing or erection purposes.

If conduits are to be installed in the foundations, the relevant information such as diameter, length, and purpose shall be indicated on the drawings.

2.2.2 Arrangement Drawings

All arrangement drawings shall be drawn to scale. The General Arrangement Drawings shall show the physical arrangement of Works/ equipment/assemblies in relation to each other and to agreed co-ordinates and boundaries.

The Arrangement or Layout Drawings of electrical and instrumentation and control equipment shall indicate the location of all apparatus wherever used, i.e. in or on machines, control boards, switchboards, cubicles, control desks and panels, etc. The apparatus shall be denominated with the same standardised abbreviations as used in all other documents.

2.2.3 Outline Drawings

The Outline Drawing shall show all elements and the main dimensions of individual components where necessary in plan view, cross-section, side and top views. If reasonably possible such dimensions can be shown on arrangement Drawings.

2.2.4 Civil Work Guide Drawings

Civil work Guide drawings shall be drawn to scale. The drawings shall include all civil interfacing details like dimensional details of all openings, cut-outs, insert plates, foundations, trenches, trench cover, rail embedment and floor loading etc. These drawings shall be complete in all respect for working as a reference for preparation of civil construction drawings. Wherever all such information/details are not possible to be included in the drawing of any area, civil work guide drawing shall include all such references of other drawings.

2.2.5 Design Drawings

The Design Drawings shall include outline drawings, assembly manufacturing drawings of components, erection drawings, showing the dimensions, design and data of all constructions, apparatus and Works to be furnished under this Contract The drawings shall - where applicable - substantially conform to the Tender Drawings and shall show:

i) Assembly of the Works in plan and elevation with main dimensions
ii) Sub-assembly of the principal components of the Works with overall dimensions, adjustment and clearance tolerances, and numbers of corresponding detail drawings.
iii) Sub-assemblies in which the Contractor proposes to ship the Works
iv) All necessary details of the parts connecting to the Works supplied by others
v) Location and size of the instruments and accessories provided.
vi) Method and sequence of installation & erection

2.2.6 Installation Drawings

The construction, mechanical, electrical and I & C Installation Drawings shall provide detailed information on the disposition of the various items of a system.

2.3 Diagrams

For electrical diagrams general reference is made to IEC 113-1.

Notwithstanding reference made to various standards all equipment and works as per provisions and requirements of relevant and latest Indian Standards shall be acceptable. Size of cables, direction of power flow, upstream device detail, all CT & PT details, relay setting, OTI & WTI setting should be displayed at Main Control Room as per norms.

2.3.1 Block Diagrams

The Block Diagrams shall be used to show in a simplified manner the main inter-relationships between the elements of a system by means of symbols, block symbols and pictures without necessarily showing all the connections. The symbols used for the individual kinds of components etc., shall clearly be explained on the diagram or on an attached legend.

When recommendable, a Block Text Diagram may be prepared, consisting essentially of explanatory texts enclosed in outlines which are linked by lines showing the functional relationships that exist between the various parts of an installation, Works or circuit.

2.3.2 Logic Diagrams

The Logic or Functional Diagrams shall be used for representation of logic and sequence controls and interlocking by showing only binary logic elements and their effect on the various process equipment disregarding their electrical realisation. Logic function elements (AND, OR, NOR, NAND, STORAGE, etc.) shall be used for processing and combining binary signals.

2.3.3 Schematic/Single-Line Diagrams

This is a simplified diagram of the essential Works and their interconnections. Each circuit shall be represented by a single line only. It shall contain all required technical information of the Works represented.

Single-line diagrams of individual main components and switchboards shall additionally show the control, indicating, measuring, metering, protection, automatic and other auxiliary devices separated for each individual installation site and location as applicable:

Furthermore, the applied recommended setting of adjustable devices (protection and control elements, time relays, etc.) shall be indicated.

2.3.4 Electrical Circuit Diagrams

The Circuit Diagrams shall show the power circuits in all the phases with the main apparatus as well as the pilot circuits (measuring and control circuits). It shall show in full the functioning of part or all installations, Works or circuits with all required technical information.

The control part shall be subdivided into separately drawn "current paths", each showing all its components regardless of their actual physical location. The individual circuits are to be drawn in a straight-line sequence, avoiding line crossings. The current paths (to be designated by numbers) shall be drawn starting from two horizontal lines, which represent the control voltage source. All devices belonging to the Works or forming part of the Works or control devices shall appear between these two lines.

Contact developments of the installed switches, contactors, relays and other apparatus which appear in the diagram shall be shown below the respective contactor coil, indicating by means of numbers and, if not on the same, also the page No., the current path in which the corresponding contact has been used.

Interconnections to other circuit diagrams shall be clearly marked by means of dotted line separations and the corresponding functional designation. The power circuit portion of the installation shall be drawn at the left side of the drawing.

Circuit diagrams shall also contain all terminals and their correct designations. Terminals grouped together to terminal blocks of switchboards, distributors, etc. shall be shown on the circuit diagrams in one fictitious horizontal line surrounded by demarcation lines. If, for any reason, the current paths of circuit diagrams must be separated, the corresponding counter terminal has to be indicated by all means.

The representation of electrical Works and control circuits shall not be terminated at the limits of the scope of supply, but has to be extended beyond this limit by all switchgear, protective, measuring and monitoring equipment required for full comprehension of the whole circuit.

Standard Circuit Diagrams are patterns of circuit diagrams which have been standardised with regard to scope, arrangement, representation and allocation of Works with the aim of simplification and easy surveillance of electrical circuitry.

2.3.5 Terminal Diagrams

Such diagrams shall be prepared for any type of terminal box, marshalling rack, control cubicle, switchboard, etc., and shall show the terminals (properly numbered) and the internal and/or external conductors (wires or cables) connected to them.

The terminal diagram of each individual switchboard, terminal box, panel, etc. shall contain, but not be limited to the following information:

Terminal number of terminal board with targets (terminal number and current path) of incoming and outgoing cables and wires

i) Cable designation
ii) Type of cable
iii) Number and cross-section of conductors
iv) Assignment of conductors
v) Number of spare conductors
vi) Approximate length of cable and its destination

2.3.6 Protection Co-ordination Diagrams

These diagrams shall show in a graphical manner separately for each power supply circuit:

i) A simplified single-line diagram of the circuit with technical data of all instrument transformers and relays
ii) Co-ordinated tripping curves of related protection devices
iii) Setting of the protection devices

2.3.7 Emergency Shutdown Diagram

This diagram shall show the sequential steps and interdependencies during emergency shutdown of the plant.

2.4 Design Calculations

In addition to the drawings or whenever the contractual documents do so require, the Contractor shall submit to the Engineer in-Charge for checking, the appropriate calculations for determining the main sizes, stress levels, dimensions and operational characteristics, safety factors, clearly indicating the principles on which the calculations were based. The calculations shall include the formulae, standards, test results, basic assumptions, etc. Submission of computer calculations without baseline information such as derivation of the calculation method, applied formulas, definition of variables and constants, explanation of abbreviations etc., will not be accepted.

2.5 Installation and Commissioning Procedures

2.5.1 Installation Procedures

The installations procedures shall describe in sequential steps the erection of major equipment.

2.5.2 Pre-Commissioning Tests and Procedures

Pre-commissioning tests and procedures shall be described in sequential steps for the pre-commissioning of all electrical and mechanical equipments and shall also contain sufficient details viz. checking of installations, ratings, cable terminal checking and operation test of all auxiliary equipments etc.

2.5.3 Commissioning Procedures

The commissioning procedures shall sequentially and in sufficient detail describe activities and tests for all systems covered by the Contract Document.

2.5.4 Commissioning Test

Commissioning and acceptance tests shall be carried out, on all equipments to verify the rating characteristics in accordance to relevant standards. The complete field acceptance test reports shall be prepared by the Contractor and submitted for approval.

2.6 Operation and Maintenance Manuals

2.6.1 Contents

The Operation and Maintenance Manuals shall be provided in five (5) hard bound copies along with DVD or any permanent storage device (Five sets), and shall

contain the following information in sufficient detail to enable the Employer to maintain, dismantle, reassemble, adjust and operate the Works with all its items of Works and installations:

1) Table of Contents

2) List of Illustrations

3) Introduction

The Introduction shall contain:

a) A brief general description of the Works items
b) A brief description of the use of the Works items
c) Definitions of technical terms used in subsequent graphs of the instruction book
d) A complete list of all items used in accordance with the Works Components Identification System.

4) Detailed Description

Detailed description shall contain a complete and accurate description of the Works, all components and ancillaries, their assembling and dismantling.

5) Operating Principles and Characteristics

A brief summary of the technical operating principles of the Works, including diagrams, circuit diagrams, sequence diagrams, etc.

6) Operating Instructions

The instructions shall be accurate and easy to understand, and shall contain the sequence of individual manipulations required for operation. The information shall be presented in such a manner that the contents of this paragraph can be used for instructing personnel in the operation of the Works. Tables, lists and graphic presentations should be used whenever possible for making the description readily understandable. An appropriate trouble-shooting list shall be included in this chapter.

7) Testing and Adjustment

The entire testing and adjustment procedure required for the Works after overhauls and during operation shall be described.

8) Maintenance Instructions

This section is divided into six paragraphs:

i) Preventive maintenance, indicating the inspections required at regular intervals, the inspection procedure, and the routine cleaning operations, the regular safety checks and similar steps.

The maintenance instructions shall include a tabular (or in other approved form) summary of the required activities sorted according to

a) Weekly
b) Monthly
c) Quarterly
d) Yearly
e) (Or other) cycles as applicable

This document shall provide the maintenance engineer with brief and yet fully comprehensive information including all references to the applicable, detailed service and maintenance instructions.

ii) Repair and adjustment, describing the inspections, fitting and dismantling of parts, fault tracing as well as repair and adjustment procedures

iii) Spare part lists, containing all the necessary data for ordering spare parts. These lists shall include all spare parts, those to be supplied and those not to be supplied under the present Contract. The prices for spare parts shall be indicated in the list. The above list should include minimum and maximum quantities of spares to be maintained by the project.

iv) Tool lists, containing all necessary data for identification of tools to be delivered under the present Contract.

v) List of suppliers and alternative suppliers and addresses

vi) As-built drawings

2.6.2 Operation and Maintenance Manual Drawings

Each kind of drawing aforementioned shall have a uniform size. The final size of drawings for the Operation and Maintenance Manual shall be decided by the Engineer in-Charge. Catalogue sheets, illustrations, printed specifications, etc., shall be checked and prepared by the Contractor in such a way that the figures, statements and data valid for the delivered sizes and types of the Works concerned are clearly marked. All figures, statements and data valid for sizes and types not delivered must be crossed out.

2.6.3 Revisions and Supplements

The completeness of the manuals shall be checked during installation, testing and commissioning jointly by the Contractor and Engineer in-Charge.

If it becomes evident during the installation, commissioning and defects liability period of the Works that the Operation and Maintenance Manuals are inadequate or incorrect, the Contractor shall supply immediately the necessary supplements and corrections. This shall be handled in the following manner:

A) Deletions:

One sheet of errata, printed on pink paper, shall be issued indicating the pages and date of issue of those pages, which are to be deleted, and are no longer valid.

B) Corrections, Revisions, Replacements:

New sheet (s) shall be issued to replace the wrong pages. Whenever a new sheet is added to the instruction manuals, this sheet shall be given the new date of issue and a revision symbol, and an indication "Substituted for ... " and a marking of the corrected/revised items.

C) Insertions, Supplements:

Insertions or supplements shall be accompanied by a new respective "Table of Contents" page, where the latter shall be handled as described above under replacements.

The revisions and supplements requested by the Engineer in-Charge shall be made by the Contractor at the Site as far as possible and shall be submitted in each case to the Engineer in-Charge for checking and revision as stated above.

Before issuing the "Taking-Over Certificate", the revised copies of the Operation and Maintenance Manual shall be submitted together with the specified number of complete sets of drawings of the Works as completed. The Works shall not be considered complete for purposes of taking over under the terms of the General Conditions of the Contract until the above documents have been supplied by the Contractor.

2.7 Progress Reports during Design and Manufacturing

During design and manufacturing the Contractor shall monthly submit four (4) copies of the progress reports in a format acceptable to the Engineer in-Charge, detailing the progress of the work during the preceding period. The report shall contain (but not be limited to) the following information:

i) A general description of the Works performed during the reporting period on each main activity, and includes any notable problems, which were encountered.

ii) The total overall percentages of design and manufacturing works completed, with reference to the CPM programme. Appropriate comments shall explain any differences.

iii) The percentages of each main work activity completed during the reported month with reference versus the scheduled programme. Appropriate comments shall explain any differences.

iv) A list of all activities of scheduled and actual progress during the reporting period including actual starting dates versus scheduled starting dates and actual completion dates versus scheduled completion dates for each activity. Appropriate remarks shall explain any differences, and also methods/actions prepared to be taken for making up the deficiencies in actual design and manufacturing process.

v) A list of activities scheduled to be started within the next period of One (1) months, with expected starting and completion dates. If the expected starting and/or completion dates are different from those shown on the CPM programme, an explanation shall be given.

2.8 Progress Reports during Installation at Site

During erection the Contractor shall, before the tenth (10th) day of each calendar month, submit four (4) copies of the monthly progress reports in a format acceptable to the Engineer in-Charge, detailing the progress of the work during the preceding month. The report shall contain (but not be limited to) the following information:

i) A general description of the Works performed during the reporting period on each main activity, and includes any notable problems, which were encountered.

ii) The total overall percentages of erection works completed, with reference to the CPM programme. Appropriate comments shall explain any differences.

iii) The percentages of each main work activity completed during the reported month with reference versus the scheduled programme. Appropriate comments shall explain any differences.

iv) A list of all activities of scheduled and actual progress during the reporting period including actual starting dates versus scheduled starting dates and actual completion dates versus scheduled completion dates for each activity. Appropriate remarks shall explain any differences.

v) A list of activities scheduled to be started within the next period of one (1) months, with expected starting and completion dates. If the expected starting and/or completion dates are different from those shown on the CPM programme, an explanation shall be given.

vi) A list of local manpower (by trade classification) employed during the reporting period.

vii) A list of expatriate personnel (by position) employed during the reporting period (if applicable).

viii) A list of the Contractor's Equipment and materials presently located at the Site. Also a list of equipment and materials, which arrived at Port of entry and is in the process of being cleared through customs.

ix) Progress photographs of significant events. The Engineer in-Charge may direct the inclusion of specific photographs if deemed necessary.

x) A statement detailing the status of progress on the overall programme and how to regain any lost time or setbacks, which may have occurred.

xi) A listing of each accident at the site involving the hospitalization and/or death of any person

xii) A listing of the amount & date of any payments received during the reporting period & the amount of any monthly invoice, which has been submitted but not yet paid.

xiii) A list of claims (if any) submitted during the reporting period including the claimed cost & extension of time.

3 SPARE PARTS AND TOOLS

3.1 Spare Parts

All spare parts to be supplied shall be interchangeable with the corresponding parts of all the Works supplied under these Specifications and shall be of the same material and workmanship. They shall be replaceable without cutting or destruction of adjacent components. Before issue of the Taking-Over Certificate the spare parts shall be checked at the Site by the Contractor in presence of the Engineer in-Charge/Employer.

Acceptance of any spare parts will not take place before the Contractor has submitted the complete final detailed list of all spare parts and tools.

All spare parts shall be protected against corrosion and shall be marked with identification labels in the English Language. The identification shall be in accordance with the agreed Works Identification System.

All spare parts, tools and materials shall be delivered in marked boxes of sufficient sturdy construction to withstand long term storage.

3.1.1 Specified Spare Parts

The required specified spare parts are listed separately in the Particular Technical Specifications.

3.2 Tools and Appliances

The scope of work shall include all customary and special tools, as well as auxiliary devices including lifting devices, ropes, etc. necessary for total assembly and disassembly of all parts of the supplied Works. Furthermore, the tools for maintenance shall be supplied and included in the Tender. The total price for tools and devices as required by this article shall be included in the Total Tender Price.

The tools, wrenches, etc. shall be unused. Customary tools for erection shall be of the forged and polished chrome-vanadium type. Use of special tools and devices for erection shall be allowed, but shall be approved by the Engineer in-Charge in each case. Special tools and devices shall be provided with means for ready identification.

All lifting devices and slings to be used at site shall be tested at works and test certificate shall be supplied to the Engineer in-Charge.

Suitable hardwood or steel boards arranged for wall mounting as well as tool carts and/or toolboxes shall be included in the delivery. An itemised list and description of all provided tools, auxiliary devices, storage equipment, etc. shall be included in the Tender. Acceptance of any tool or device shall not take place before the Contractor has submitted the complete final detailed List of Tools and Appliances.

Ropes, slings etc. shall be handed over in new condition. The Employer shall be entitled to take over from the Contractor the entire erection tools, appliances, instruments at mutually agreed conditions.

4 DESIGN AND MANUFACTURE

4.1 General

Design, manufacture and construction requirements shall generally be as described below besides complying with the specific requirements elaborated in particular technical specification

4.2 Design and Construction Requirements

The following directions, information and technical requirements for layout, design and manufacture shall be observed as far as they are applicable to the Works to be offered. The technical requirements of the General Technical Specifications are valid for all parts of the Works except where they are modified by additional and/or special requirements, specified in the Particular Technical Specifications.

Whenever a Contractor deviates from these Specifications, he shall furnish the data called for in the Technical Data Schedules and give a summary of and the reasons for all deviations in the "List of Deviations''. Failure to accomplish this may cause the elimination of his Tender, especially when a major deviation is involved.

Any changes of the design of any part of the Works, which may become necessary after signing the Contract, have to be submitted in writing to the Engineer in-Charge for approval, being sufficiently substantiated and justified.

The parts of the Works shall be designed and arranged so that they can be easily inspected, cleaned, erected and dismantled without involving large scale dismantling of other parts of the Works. They shall be designed, and manufactured in accordance with the latest recognised rules of workmanship and modern engineering practice.

The regulations, standards and guidelines listed in these Specifications shall be observed in the design, calculation and manufacture of the Works.

All parts of the Works shall be suitable in every respect for continuous operation at maximum output efficiency under the climatic conditions and operating conditions prevailing at the Site.

Special attention shall be given to Works, parts of which are delivered by different manufacturers. Problems arising in this connection shall be solved by the Contractor and be defined in writing.

All live, moving and rotating parts shall be adequately secured in order to avoid danger to the operating staff.

Manufacturers shall take appropriate measure to prevent the ingress of dust into any Works (such as relays, control and measuring equipment, etc.), which may be endangered thereby.

Suitable lifting eyes and backing-out bolts shall be provided where required or where they will be useful for erection and dismantling.

All design details and layout matters shall be discussed in periodic meetings with the Engineer in-Charge. The first design meeting between the contractor and the Engineer in-Charge shall take place within 30 days after the date of signing of the contract or placement of the order. Further design meetings shall take place as agreed between the participants until the design work is completed.

4.3 Design Criteria

The plant equipment shall be designed for the worst possible combination of the following loading conditions as applicable:

i) All static and dynamic loads,
ii) All loads due to dead weight and frictional forces,
iii) Seismic or wind loads, and
iv) Other loads.

4.3.1 Seismic Conditions

The bidder shall consider seismic zone III of India for Designing of various project components.

4.4 Standardisation of Works

Every effort shall be made to standardise parts and minimise costs of the Works throughout the Works in order to facilitate keeping stocks, maintenance, replacement, interchangeability, etc.

Small electrical & mechanical works such as:

i) Terminals & terminal racks
ii) Indicating instruments & meters
iii) Auxiliary relays
iv) Contractors, fuses
v) Motor protection switches
vi) Control devices
vii) Lights, bulbs, plugs, sockets

The types or makes to be used shall be decided later by the Engineer in-Charge. All instrument scales shall be written in the ruling language of the contract and in the international SI- System of units.

4.5 Noise

The noise level caused by the installed Works shall not exceed the following values if not otherwise stated in the Particular Technical Specifications:

i) Inverter rooms max. 85 dB (A) at any place 1 m distant from operating equipment
ii) Offices, control rooms etc., max. 55 dB (A)

The noise level definition and measurement shall be in accordance with IS. The values stated shall be adhered to taking a normal civil construction into account.

4.6 Safety

4.6.1 Safety of Personnel

Where specific standards are not mentioned by the Employer, all equipment and services provided under this contract shall abide by international standards commonly accepted in the Solar utility industry for safety of personnel whether involved with operation or maintenance. All operations and routine maintenance

interventions shall be completely safe and designed to be carried out under normal conditions of access and while the equipment is operating.

First aid kits, chart containing instruction for resuscitation of person suffering from electric shock, respiratory kit, gloves, rubber shoes, safety belts, ladders ,earthing devices, helmets, arc suits and other life protecting equipment against mechanical and electrical injury should be provided at switchyard/control room as per norms and maintained in good condition.

4.6.2 Safety of Operation

All equipment and services provided under this contract shall abide by applicable standards for safety of operation.

The overall design shall comprise a substantial degree of conservatism, especially with respect to the selection of the design parameters and of the components critical to the safety and reliability of the operation. Safety sign board to be provided near outdoor transformer yard, HT switchgear and all such risk zone areas.

4.6.3 Handling Provision

Lifting lugs, brackets, eyes, and other items required for attaching lifting devices shall be provided on all the major components of the equipment weighing more than 24 kg for safe handling. All slings and lifting devices required for attachment to the components and assemblies and to a crane hook for safe handling during erection and later disassembly shall be furnished.

4.6.4 Availability and reliability

The Contractor shall design each equipment, system or subsystem to provide a high level of availability and reliability.

The “Electrical & Mechanical Works” shall be designed, constructed and integrated using components and systems which have been proven in other plants of similar application and have shown low failure rates in such applications.

4.6.5 Interchange-ability

The Contractor shall optimise the various systems and subsystems to minimize the number of different components and associated spare parts. Equipment fulfilling the same or similar functions at various locations shall whenever possible use the same material.

Homologous parts shall be interchangeable without needing any adjustment.

All equipment, parts and elements of mass production shall be standardized. These pieces of equipment, parts and elements shall include but not be limited to the following, bolts, nuts and threads, and electrical instruments and measuring devices, terminal and terminal boxes, primary, secondary and auxiliary relays, contactors, fuses and switches, lamps, bulbs sockets push buttons, control modules, I/O modules, etc.

Where the equipment supplied under this Contract comprises identical pieces of equipment each of their corresponding removable parts shall be fully compatible and interchangeable for use in the other, without adjustment to the remaining parts.

4.7 Identification Plates

4.7.1 General

Each important part to be delivered under this Contract shall be equipped with permanent identification plates in readily visible locations. Whether a part shall be considered as important in this respect shall be decided by the Engineer in-Charge.

The identification plates shall be protected during erection and especially during painting. Damaged or illegible identification plates shall be replaced by new ones. The identification plates of non-corroding, non-disintegrating material (except manufacturer's nameplates of small standardised components) shall be inscribed in the Contractual language.

The inscription shall be printed or stencilled, but in any case, waterproof, oil-proof and wear-resistant. Works (equipments, transformers, etc.) nameplates shall be either of the enamelled type or be of stainless steel covered after stamping with a transparent paint. Wording, size and material of all labels and plates shall be subject to the Engineer in-Charge's approval.

4.7.2 Manufacturer's Nameplates

The following data shall be shown in accordance with the relevant standards:

i) Manufacturer’s name and address
ii) Work's serial number and date of manufacture
iii) Main design data

As a general rule, standardised components may be delivered with the manufacturer's standard nameplate.

4.7.3 Functional Plates/ Instruction Plates

Each part appearing under a certain symbol or number in functional diagrams, in the Operation and Maintenance Instructions, etc., shall be equipped with a plate showing the same symbol or number.

4.8 Colour Coding For Electrical Connections

Live parts of electrical connections shall be colour coded as follows:

Conductor Designation	Coding Alphanumeric	Symbol	Colour
A.C. network 3 phase	Phase 1	R	Red
	Phase 2	Y	Yellow
	Phase 3	B	Blue
	Neutral	N	Black
A.C. single phase	Phase	P	Red
	Neutral	N	Black

	Earth	E	Green-yellow
D.C. Network	Positive	a	Red
	Negative	b	Black

4.9 Workmanship

4.9.1 Painting Systems

Annexure-I "Painting Schedule", indicates painting guidelines and materials considered suitable for the various parts of the Works. Painting in respect of standard items shall be acceptable as per manufacturer practice.

4.9.1.1 Painting Materials

The Contractor shall provide a complete, reliable coating system. Coating materials shall be standard products of a paint manufacturer with proven experience in the field of corrosion protection of the type of works to be supplied.

The Contractor shall submit for the Engineer in-Charge's approval full details of the preparation, type of materials, methods and sequences he proposes to use to comply with the requirements for the protection of the Works.

Painting of the repainted surface shall be in accordance to the relevant standard and shall be detailed by the Contractor for Engineer in-Charge's acceptance.

4.9.1.2 Galvanising

Unless otherwise specified, all structural steel including ladders, platforms, hand rails and the like and all exterior and interior steel surfaces of outdoor Works, as well as bolts and nuts associated with galvanised parts shall be hot-dip galvanised, electro-lytically galvanised or sheradized, as may be appropriate to the particular case.

A) Material:

For galvanising, only original blast furnace raw zinc shall be applied, which shall have a purity of 98.5%.

The thickness of the zinc coat shall be:

i) For bolts and nuts, approx. 60 micrometer
ii) For all other parts, approx. 70 micrometer

B) Galvanising of Hardware:

Bolts, nuts, washers, locknuts and similar hardware shall be galvanised in accordance with the relevant standards. Excess spelter shall be removed by centrifugal spinning.

C) Straightening after Galvanising:

All plates and shapes, which have been warped by the galvanising process, shall be straightened by being re-rolled or pressed. The material shall not be hammered or otherwise straightened in a manner that will injure the protective coating. Materials that have been harmfully bent or warped in the process of fabrication or galvanising shall be rejected.

D) Repair of Galvanising:

Material on which galvanising has been damaged shall be re-dipped unless the damage is local and can be repaired by soldering or by applying a galvanising repair compound; in this case, the compound shall be applied in accordance with the manufacturer's instructions.

Soldering shall be done with a soldering iron using 50/50% solder (tin and lead). Surplus flux or acid shall be washed off promptly and the work shall be performed so as not to damage the adjacent coating or the metal itself. Any member on which the galvanised coating becomes damaged after having been dipped twice shall be rejected.

4.9.1.3 Painting Guarantee

The guarantee period for all painting shall be 2 years, starting from the issue of the "Taking-Over Certificate". This painting guarantee period shall be effective regardless of any other guarantee periods for the project or parts of the project, or any "Defects Liability Certificate", issued prior to the elapse of the painting guarantee period.

At the end of the painting guarantee period the anti-corrosive protection of the painted or galvanised surfaces shall not have a degree of rusting higher than RE 1 (one) on the European scale of degree of rusting for anti-corrosive paints, (the corrosion committee of the Royal Swedish Academy of Engineering Sciences, Stockholm).

4.10 Metal Work

4.10.1 Embedded Metal Work

The contractor shall supply & install all anchors, fasteners, piping, & sleeves associated with & required for the equipment to be installed under this contract, except if otherwise mentioned in the specifications.

As far as practicable, the supports shall be of consistent design throughout. Attachments to concrete shall wherever practicable be by means of embedded inserts.

The Contractor shall be responsible for the determination and details of all loads and forces exerted by his equipment and transferred to the foundation.

Any steel work which is to be built into the concrete foundations shall not be painted or coated unless otherwise approved or specified.

5 MECHANICAL WORKS AND STEEL STRUCTURES

5.1 General

All mechanical Works and steel structures of any mechanical or electrical installation shall comply with this General Technical Specification and the requirements of the Particular Technical Specification.

The Works shall be of an approved, reliable design providing the highest possible degree of uniformity and interchangeability.

5.2 Materials

Materials shall be new and of high-grade quality, suitable for the purpose, free from defects and imperfections, and of the classifications and grade meeting specification requirement and shall be subjected to acceptance by the Employer. Material specifications, including grade or class shall be shown on the appropriate Contractor's detail drawings submitted for review.

All materials or parts used in the equipment shall be tested in conformity with the standards accepted by the Employer.

Certified Material Test Report for the materials of major/important components and/or materials for special application shall be furnished to the Employer as soon as possible after the tests are performed. Each test certificate shall identify the components for which the materials are used and shall contain all information necessary to verify compliance with the contract.

5.3 Bolts, Screws, Nuts etc.

All bolts, studs, screws, nuts, and washers shall be to the ISO standard (metric system) except other standards will be considered for specific applications. The extent to which other standards are proposed shall be indicated by the Contractor.

Where mild steel bolts and nuts are used, they shall be of the precision cold forged washer faced type if commercially available in the size required. Alternatively, approved hot forged bolts and nuts, machined so that the undersides of bolt head and nut are faced and parallel to one another when assembled, may be used. In the latter case, a suitable fillet shall be machined between the bolt head and shank. All parts, other than structural steel work, bolted together, shall be spot faced on the back to ensure that nuts and bolt heads bed down satisfactorily. Bolts machined from bar stock shall not be used without approval of the Engineer in-Charge. All bolting material shall be adequately treated against corrosion before dispatch from the workshop. Mild steel nuts and bolts shall be zinc or cadmium plated. All bolts or studs which will be subject to high stress and/or temperature shall be of approved high tensile material with nuts of approved material. All bolts and studs larger than 60 mm in diameter, which are not accessible for tightening, and untightening by commercially available pneumatic impact wrenches shall be drilled for heaters or shall have an extension for pre-tensioning by hydraulic tools.

Washers shall be provided under bolt heads and nuts unless otherwise approved by the Engineer in-Charge. All ferrous nuts and bolts on Works items where dismantling may be required during the life of the Works shall have their threads coated with an approved anti-seize compound. When in position, all bolts or studs shall project through the corresponding nuts by at least one thread, but this projection shall not

exceed three threads, unless more length is required for adjustment. All nuts and set screws shall be securely fastened, to prevent loosening due to vibrations, using spring washers, lock nuts, split pins, self-locking inserts or 'Loctite' as appropriate for the purpose and material used.

The Contractor shall supply the net quantities plus 5 percent of all permanent bolts, screws and other similar items and materials required for installation at the Site. Any such rivets, bolts, screws, etc., which are surplus after the installation of the Works has been completed shall become spare parts and shall be wrapped, marked and handed over to the Employer.

5.4 Corrosion Resistant Bolts and Nuts

Corrosion resistant steel or bronze shall be used for bolts and nuts when either or both are subjected to frequent adjustment or frequent removal, such as adjusting bolts for packing glands on removable screens or strainers, on adjustable bearings, rubber seal holders, etc. Protective measures against electrolyte corrosion shall be foreseen where necessary.

5.5 Piping, Fittings and Valves

5.5.1 General

Unless otherwise stated, all piping fitting, valves shall be designed for at least 1.5 times of the working pressure but minimum for "nominal pressure" PN 10 and tested with 1.5 times of the design pressure.

5.5.2 Valves

Generally, valves shall be leak-proof in either flow direction (except for non-return valves) when the design pressure is applied.

All valves with design pressures higher than PN 30 and diameters larger than DN 100 shall be workshop-tested to relevant IS for tightness and soundness of materials.

Valves shall close clockwise and be provided with position indicators and padlock kit.

Unless otherwise specified in Particular Technical Specification, valve type used in water, oil and air application shall be as per below:

1) Water application

i) All the valves connected to for fire fighting system tapping shall be heavy duty forged gate type. The same shall be capable of open under 100% unbalance condition.
ii) All valves for flow regulation shall preferably be heavy duty globe type.
iii) All valves which are to be frequently opened and closed shall be heavy duty gate valves.
iv) All valves used in fire fighting system shall necessarily be heavy duty gate valves.
v) Generally, all valves up to DN80 shall be heavy duty gate valves (except in flow regulation).

5.5.3 Piping and Fittings

All required piping shall be furnished complete with flanges, joints, expansion joints, gaskets, packing, valves, drains, vents, pipe suspensions, supports, etc.

5.5.4 Pipe Supports and Hangers

All pipe work and accessories shall be mounted and supported in a safe and neat manner for indoor application

All brackets, stays, frames, hangers and supports for carrying and staying the pipes, including their fasteners shall be included in the supply and completed by the Contractor at the Site. Pipes and fittings shall be supported at or near flanges wherever possible.

5.6 Pumps

Materials of the Impeller, Shaft and Sleeves of the pumps shall be stainless steel. The pump casing for horizontal centrifugal pumps shall be cast steel and ductile/improved cast iron respectively. The impeller diameters shall be neither maximum nor minimum impeller size for the selected pump size. The pumps shall withstand corrosion and wear by abrasive matters within reasonable limits. Leakage water shall be directed to suitable drainage facilities.

Each pump shall be fitted with:

i) Check valve at the discharge side
ii) Air and drain valve
iii) Pressure gauge & pressure / flow switch.

The size of the pump motor shall be at least 10 % higher than the maximum power required by the pump at any operation point. The pumps and motors shall be mounted on the frames.

6 ELECTRICAL WORKS

6.1 General

The electrical items of Works of any electrical or mechanical installation to be provided under this Contract according to the Particular Technical Specifications shall - if not stated otherwise therein-fulfil the requirements of this Section.

All components shall be of an approved and reliable design. The highest extent of uniformity and interchangeability shall be reached. The design shall facilitate maintenance and repair of the components.

The Works shall be pre-assembled to the highest possible extent in the Contractor or Sub-Contractor's workshop, complete with all devices and wired up to common terminal blocks.

The power supply and control cables shall be laid up to these common terminal blocks.

Unless otherwise agreed, ratings of main electrical Works (infeeds, bus-ties) as selected or proposed by the Contractor, whether originally specified or not, shall generally include a safety margin of 10% under consideration of the worst case to be met in service. Prior to approval of such basic characteristics, the Contractor shall submit all relevant information such as consumer lists, short circuit calculations, derating factors, etc.

Short-circuit calculations shall be evaluated giving full evidence that every electrical component can withstand the maximum stresses under fault conditions, for fault levels and durations obtained under the worst conditions, e.g., upon failure of the corresponding main protection device and time delayed fault clearing by the back-up protection device.

All Works shall be suitable for the prevailing climatic conditions.

An outdoor installation needing protections shall be protected against solar radiation by means of adequate covers, where required.

The Contractor shall ensure that all the supplied Works is insensitive to any signals emitted by wireless communication equipment.

6.2 Standards

The design, manufacture and testing of all Works and installations shall strictly comply with the latest edition of the relevant IEC publications.

6.3 Colour Code

In general, the colour code for electrical Works shall be as described in the Particular Technical Specifications.

The manufacturer's painting systems shall be used to the maximum possible extent, but shall by all means be subject to the approval of the Engineer in-Charge. Final coats of paint shall be matching adjacent installations, where required.

6.4 Electric Motors

6.4.1 General

All motors shall be of approved manufacture and shall comply with the requirements of this Chapter. Motors of the same type and size shall be fully interchangeable and shall comply - as far as applicable - to IEC standard motor dimensions. The insulation of all motors shall be class 'F'.

All motors shall be of the totally enclosed fan-cooled type, protection class IP 54 according to IEC Recommendation 144. Cable termination points shall be of class IP55. Each motor shall be factory tested.

Motors installed outdoors and directly subjected to solar radiation shall be rated such as not to exceed a maximum metal temperature of 85°C. Where necessary, such motors shall be provided with sun shields.

6.4.2 Terminal Boxes and Earthing

The terminal leads, terminals, terminal boxes and associated equipment shall be suitable for terminating the respective type of cables as specified in these General Technical Specifications and in the Particular Technical Specifications.

The terminal boxes shall be of ample size to enable connections to be made in a satisfactory manner. Supports shall be provided at terminal boxes as required for proper guidance and fixing of the incoming cable.

The terminal boxes with the cables installed shall be suitable for connection to supply systems with the short-circuit current and the fault clearance time determined by the motor protective devices.

A permanently attached connection diagram shall be mounted inside the terminal box cover. If motors are provided for only one direction of rotation, this shall be clearly indicated.

Terminal boxes shall be totally enclosed and designed to prevent the ingress of moisture and dust. All joints shall be flanged with gaskets of neoprene or similar material. For motors above 1 kW, the terminal box shall be sealed from the internal air circuit of the motor.

Depending on the size, the terminal box of L.V. motors shall be fitted either with cable sealing-end or with a gland plate drilled as required and provided with suitable fittings for cable fixing and sealing. Such openings shall be temporarily plugged or sealed during transportation.

For earthing purposes, each motor shall have adequately sized bolts with washers at the lower part of the frame. In addition, each terminal box shall contain one earthing screw. Each equipment/panel shall be earthed by at least two separate earthing strips.

The cable termination philosophy to be adopted shall be such that extensive grouping of signals by large scale use of field-mounted group. JB'S at strategic locations (where large concentration of signals are available, e.g. switchgear) is done. Termination/Junction boxes shall have either maxi- terminal or cage clamp type terminals

6.5 Cubicles and Panels

All control cubicles/panels, switch gear panels and other cubicle/panel enclosures shall be UL/Lloyds register of shipping/VDE approved and would be of cold rolled sheet steel. Cubicles/panels shall have full modularity along X-Y-Z axis made out of folded profile based structure with reference to the requirement of combinability of the panels which shall be finalized during detailed design with respect to the layout.

Such structure shall be made by a sheet of not less than 1.5 mm. However, doors can be extracted through a sheet of 2mm which could be of rigid construction and the sides where no instruments/MCB/relay is to be installed can be provided with a cover sheet of not less than 1.5mm which shall be approved during detailed design based upon the construction of panel. Further top and bottom of the panels should not be less than 2mm. The structural frame shall have provision at a regular interval to facilitate retrofitting components without need of drilling holes.

In case of junction boxes, small starter panels and muslin kiosks shall be made out from a single sheet of thickness not less than 2mm which should have minimum weld interface except weld seal at the enclosing envelope. Door specification however, remain the same as of cubicles/panels having specific PU seal with reference to the IP class mentioned in the specification either under GTS or PTS.

Cubicles shall be fitted with close fitting, hinged, lift-off doors capable of being opened through minimum 120 deg. The doors shall be provided with door handles with integral lock and master key. The doors shall have PU seal for perfect sealing and longer life.

Cubicles and panels shall be vermin proof. Removable gland plates shall be supplied and located to provide adequate working clearance for the termination of cables. Under no circumstances shall the floor/roof plate be used as a gland plate. The cables and wiring shall enter from bottom or top as approved or directed by the Engineer in-Charge.

The cubicles and panels shall be adequately ventilated, if required, by vents or louvers, and shall be so placed as not to detract from the appearance. All ventilating openings shall be provided with corrosion-resistant metal screens or a suitable filter to prevent entrance of insects or vermin. Space heating elements with thermostatic control shall be included in each panel.

Where cubicles are split between panels for shipping, terminal blocks shall be provided on each side of the split with all necessary cable extensions across the splits. These cable extensions shall be confined within the panels with suitable internal cable ducts.

Unless stated otherwise, all cubicles and panels shall be provided with a ground bus with 40mm x 5mm or higher (as per requirement) copper bar extending throughout the length. Each end of this bus shall be drilled and provided with lugs for connecting ground cables ranging from 70 to 120mm^2.

The standard phase arrangement when facing the front of the motor control centres and switchboard shall be RYB from left to right, from top to bottom and front to back. All instruments, devices, buses and other equipments involving 3 phase circuits shall be arranged and connected in accordance with the standard phase arrangement, where possible. Electrical clearances shall conform to applicable standards and shall not require cutting away of adjacent framework.

All instruments, control knobs and indicating lamps shall be flush mounted on the panels. Relays and other devices sensitive to vibration shall not be installed on doors or hinged panels, and no equipment shall be installed on rear access doors.

The instrument and control wiring, including all electrical interlocks and all interconnecting wiring between sections, shall be completely installed and connected to terminal blocks by the manufacturer.

The arrangement of control and protection devices on the panels and the exterior finish of the panels shall be subject to the approval of the Engineer in-Charge. The interior of all cubicles and panels shall have a matt white finish preferably.

Switched interior light and socket outlets shall be provided for all cubicles and control panels. All cubicles and control panels shall be provided with nameplates, identifying the purpose of the panel and all of its components.

6.5.1 Starters and Contactors

Motor starters and contactors shall be equipped with short circuit protection and local disconnecting devices. Preferably, all starters shall be from one manufacturer. The control circuit voltage shall be obtained from a 415/240 V isolating transformer with primary circuit breaker and secondary fuse. The secondary winding of this transformer shall be grounded. The operating coils of the contactor shall be connected between the grounded side of the transformer and the control contacts.

Starters and contactors shall comply with IEC 292.1 and be suitable for direct on-line starting, uninterrupted electrical duty, and capable of 30 operations per hour. They shall be installed in ventilated enclosures for indoor installation and weatherproof enclosures for outdoor installation, unless otherwise approved by the Engineer in-Charge. The enclosures shall be complete with locks, cable sealing boxes, conduit entries, cable gland plates, bus bars, internal wiring, terminal boards, etc. as required by the duty of the starter or contactor.

Starters and contactors shall be of minimum size compatible with motor size and capable of satisfactory operation, without damage, for a period of 5 minutes at a voltage 25 percent below nominal, at nominal frequency.

Thermal type overload and phase failure relays shall be supplied with starters for motors of 7.5 kW or greater. For motors of less than 7.5 kW, suitable rated 3-phase thermal overloads will be acceptable. Ammeters to read current in one phase shall be provided for motors above 7.5 kW.

Each starter shall have sufficient number of auxiliary contacts required for interlocking and indication purposes plus two spare convertible contacts for Owner's use.

6.5.2 Moulded Case Circuit Breakers

All moulded case circuit breakers shall be of 2 or 3-pole type as required, having thermal time delay and instantaneous trips with "On-Trip-Off", indicating/operating mechanism. Circuit breakers used in combination type motor starters or contactors shall have the operating mechanisms interlocked with the starter or contactor cover so that the cover cannot be opened unless the circuit breaker is open. The breakers shall comply with applicable section of IEC 157/1 or equivalent standards.

6.5.3 Control Relays

Relays used as auxiliary control devices in conjunction with motor starters and magnetic contactors shall be of the type designed for machine tool application featuring contact convertibility. All contacts shall have a minimum thermal current rating of 10A over a range of 6 to 600 V AC.

6.5.4 Pilot Devices

Pilot devices such as selector switches, push-button starters and thermostats shall be of heavy duty type and, where mounted outdoors, shall be housed in weather proof enclosures specially designed for the environment.

All electrical contacts for control, alarm and shutdown shall have a thermal current rating of not less than 10 A at 220 V DC.

6.5.5 Terminal Blocks

All terminal blocks shall be mounted in an accessible position with the spacing between adjacent blocks not less than 100 mm and space between the bottom blocks and the cable gland plate being a minimum of 200 mm. Sufficient terminals shall be provided to allow for the connection of all incoming and outgoing cables, including spare conductors and drain wires. In addition, 20 percent spare terminals shall be provided. In enclosed cubicles, the terminal blocks shall be inclined toward the door for facilitating terminations.

Terminals shall be of the channel mounting type and shall comprise a system of individual terminals so that terminal blocks can be formed for easy and convenient cabling consistent with the high reliability required of the circuits.

Terminal blocks shall be provided with shorting links and paralleling links where applicable and mounting identification numbers and/or letters.

Terminal blocks shall be disconnecting link type for CT, PT and incoming supplies AC/DC & for balance fixed link type conforming to the applicable standards. The smallest size to be used shall be designated for 2.5-sq. mm wire and not more than two conductors shall be connected under one terminal clamp.

Terminal identification shall be provided corresponding to wire number of connected leads. Circuit terminals for 415 V AC shall be segregated from other terminals and shall be equipped with non-inflammable, transparent covers to prevent contact with live parts. Warning labels with red lettering shall be mounted thereon in a conspicu-ous position.

6.5.6 Equipment Wiring

All wiring connections shall be readily accessible and removable for test or other purposes. Wiring between terminals of the various devices shall be point to point.

Splices or tee connections between terminal points are not acceptable. Wire runs shall be neatly trunked inside the panels or in wiring troughs. Whenever possible, unused areas of the panels shall be kept free of wiring to facilitate the installation of future equipments.

Multi conductor cables shall be connected to the terminal blocks in such a manner as to minimise crossovers. Claw washers of crimp type connector shall be used to

terminate all small wiring. Each conductor shall be individually identified at both ends through a system providing ready and permanent identification, utilising slip-on ferrules.

Markers may be typed individually or made up from sets of numbers and letters firmly held in place. Open markers will not be accepted.

Markers must withstand a tropical environment and high humidity and only fungus proof materials will be accepted. Ferrules of adhesive type are not acceptable.

All trip circuits shall employ markers having a red background.

Sensitive control circuits shall be effectively shielded against extraneous signals and interference. A separate terminal shall be provided for termination of individual cable shields, which will be grounded at source end only.

6.5.7 Alarm Contacts

Where applicable, all alarm contacts shall be of galvanically isolated type and provide inputs to the following devices.

i) Local annunciator
ii) Station annunciator
iii) Supervisory control and sequence of events/fault recorder system

All alarm contacts shall be changeover type. Where required, relays shall be provided as contact multiplier.

6.6 Cables

The General Cable Specification shall include the calculation of the derating factors for the individual modes of installation at applicable ambient temperatures and grouping of cables, and furthermore, for each cross section:

i) The rated current carrying capacity
ii) The maximum Short-circuit capacity
iii) The voltage drop
iv) Type, insulation serving, armouring and sheathing of cable
v) Type, description and catalogue/ pamphlet of cable termination

Separate specification(s) shall be prepared for cable trays, conduits, supporting structures and other accessories.

6.7 Labels and Plates

6.7.1 General

Labels and data plates shall be provided in accordance with applicable standards and as detailed hereunder.

Where applicable, designations in the selected local language shall appear above or to the right of the designation in the Contract language. The translations into and writings in the local language shall be submitted for approval.

6.7.2 Equipment Labels and Instruction Plates

Labels written in the Contract language shall be provided for all instruments, relays, control switches, push buttons, indication lights, breakers, etc. In case of instruments, instrument switches and control switches, where the function is indicated on the device, no label is required. The label shall be fixed close to the devices in such a way that easy identification is possible. Each separate construction unit (cubicle, panel, desk, box, etc.) shall be identified by its Works identification number. Cubicles and similar units shall also bear this identification number on the rear side if rear access is possible. The overall designation of each unit shall be given in the Contract language and, if required, also in a selected local language. These labels shall be made of anodised aluminium/stainless steel with black engraved inscriptions, arranged at the top section of the units. Manufacturer's trade labels shall, if desired, appear in the bottom section of the units.

All Works inside cubicles, panels, boxes, etc., shall be properly labelled with their item number. This number shall be the same as indicated in the pertaining documents (wiring diagrams, Works list, etc.).

Instruction plates in the Contract and selected local language, the sequence diagrams or instructions for maintenance shall be fitted on the inside of the front door of the electrical switchboards.

6.7.3 Warning Labels

Warning labels shall be made of synthetic resin with letters engraved in the Contract and selected local language, where required in particular cases.

For indoor circuit breakers, starters, etc., transparent plastic material with suitably contrasting colours and engraved lettering would be acceptable.

Details are stated in the Particular Technical Specifications or will be fixed at a later date.

6.7.4 Labels for Conduits etc.

The material shall be non-corrosive and the description be done with 4 mm high letters/figures.

6.8 Labels for Cables

Each cable when completely installed shall have permanently attached to each end and at intermediate positions as may be considered necessary by the Engineer in-Charge, non-corrosive labels detailing identification number of the cable, voltage, and conductor size.

The cable identification numbers shall comply with those of the cable list.

All cables in cable pits and at the entry to buildings shall be labelled utilising the aforementioned type of label.

6.9 Rating Plates

Works (hoists, machines, transformers, etc.) rating plates and other technical data/informative plates shall either be of the enamelled type or be of stainless steel

suitably protected after engraving with a transparent paint resistant to aggressive atmosphere and solar radiation.

6.10 Single-Line Diagrams

Each switchgear room shall be furnished with a copy of the final as-built single-line diagram detailing all electrical data and denominations, separate for each individual switchgear / distribution board/MCC, placed under glass and frame/wall mounted at an approved location.

The same applies to the Station Single-Line Diagram one copy of which shall be arranged in the control room(s).

6.11 Key System for Electric Boards

Key interlocked switches shall be provided with locks for locking in the neutral position. Similar locks shall be provided for selector switches for locking the switches in any of the positions.

The locks or padlocks shall be co-ordinated for the different applications and shall be supplied with three keys. A key cabinet at the end of each board (distribution board, MCC, control cubicles, etc.) shall be provided for storing the keys of that board. All keys shall have six master keys to open any lock or padlock supplied. Each key shall have one identification label fixed above the key-hanging hook inside the cabinet.

The cabinet door keys shall be similar and shall be six (6) in number.

7 INSTRUMENTATION AND CONTROL EQUIPMENT

7.1 General

All instrumentation and control equipment shall be of internationally reputed make having proven performance and acceptability in the field.

7.2 Design Criteria

7.2.1 General

Chapter 6, "Electrical Works", shall be considered for I & C equipment as far as applicable. Special reference is made to cabling, wiring and labelling. All components shall be of an approved and reliable design. The highest extent of uniformity and interchangeability shall be reached. The design shall facilitate maintenance and repair of the components.

All components shall be suitable for continuous operation under site conditions. All components shall be compatible with other electrical, electronic and mechanical Works.

All measurements and alarms shall be listed in a measuring list of a standard form subject to Approval by the Engineer in-Charge. For remote controls, a schedule of interlocks shall be provided. The features of automatic controls shall be shown in block diagrams.

Shielded cables shall be provided for the control and supervisory equipment where required.

7.3 Measuring Systems

Electric measuring signals of 4-20 mA shall be transmitted to the control room for essential or regulating circuits. In this case the absence of live zero signal shall lead to a warning signal. Measuring signals for indicating purposes will be 4-20 mA.

The components shall quickly respond to any changes of the measured magnitudes. Measuring ranges of indicators, transducers, etc. shall be selected in such a way that the rated value of the measured magnitude covers approx. 75% of the range.

All local instruments shall, as far as practicable, be mounted vibration free to allow good reading. Wherever required, damping elements shall be used.

Corresponding systems shall be grouped together in local panels.

All local indicating instruments and test connections shall be included in the respective Works as integrated parts. The scope of local indicating instruments and test connections shall enable the operator to properly survey the Works, and shall also allow to adequately carrying out all acceptance and other tests.

The binary sensors shall be fused separately and supplied with 24 V D.C.

7.3.1 Electrical Measurements

All Electrical instruments shall be of flush mounted design, dust and moisture-proof. A.C. ammeters and voltmeters shall have digital type system of not less than 1.5 accuracy class for connection to the secondary side of instrument transformers. D.C. measuring instruments shall have digital type systems of the same accuracy. Watt

meters/energy meters shall have electro-dynamic measuring mechanisms if fed by transmitters. Watt meters shall be suitable for unbalanced systems and accuracy of energy meters should be of 0.2 % accuracy class or better.

All indicating instruments shall generally withstand without damage a continuous overload of 20% referred to the rated output value of the corresponding instrument transformers. Ammeters shall not be damaged by fault-currents within the rating and fault duration time of the associated switchgear via the primaries of their corresponding instrument transformers.

All instruments and apparatus shall be capable of carrying their full load currents without undue heating. All instruments and apparatus shall be rear connected, and the enclosures shall be earthed. Means shall be provided for zero adjustment of instruments without dismantling.

All voltage circuits to instruments shall be protected by MCB's in the unearthed phases of the circuit, installed as close as practicable to the instrument transformer terminals, or, where instruments are direct-connected, as close as practicable to the main connection. All power factor indicators shall have the star point of their current coils brought out to a separate terminal which shall be connected to the star point of the current transformer secondary windings.

When more than one measured value is indicated on the same instrument, a measuring point selector switch shall be provided next to the instrument and shall be engraved with a legend specifying each selected measuring point.

All instruments shall be of the flush mounting type and shall be fitted with non-reflecting glass and shall comply in every respect with the requirements of IEC Publication 51.

Scales shall be arranged in such a way that the normal working indication is between 50-75% of full-scale reading permitting an accurate reading. CT connected Ammeters provided for indication of motor currents shall be provided with suppressed overload scales of 2 times full scale. The dials of such ammeters shall include a red mark to indicate the full load current of the motor.

Instrument scales shall be submitted for approval by the Engineer in-Charge. All instruments mounted on the same panel shall be of same style and appearance.

Transmitter connected ammeters (for example those in mosaic-type control desks) shall have 90 degrees or 240 degrees circular scales calibrated 0-120 %. The rated motor current shall correspond to 100% scale indication.

All metering circuits shall be terminated in marked terminal blocks for remote metering purposes.

7.4 Protection Systems

Electrical/ Mechanical Protection and Interlocking Systems shall be provided for all works components and individual systems to ensure a safe and reliable operation and to limit harm and damage to personnel and works to an utmost extent.

The primary functions of these facilities shall be to disconnect selectively faulty sections of the systems prior to influence or damage to other works and to maintain operative systems as far as possible. Moreover, these devices shall facilitate the duty of the operation staff and prevent mal-operation.

8 TRANSPORT AND INSTALLATION

8.1 General

Shipping, loading, transportation, unloading, storage, erection and test running shall be performed by the Contractor.

From the time of manufacturing until commissioning all parts of the plant shall be protected and insured at the Contractor's expense against damage of any kind. Parts, which are damaged during transport, storage, erection, shall be replaced at the Contractor's expense.

The Contractor shall provide the Engineer in-Charge with complete packing lists of each performed shipment.

8.2 Packing

The contractor shall prepare all plant, devices & materials for shipment to protect them from damage in transit & shall be responsible for make good all damages due to improper preparations, loading or shipment.

After the workshop assembly & prior to dismantling for shipment to the site, all items shall be carefully marked to facilitate site erection. Wherever applicable, these markings shall be punched or painted so they are clearly visible.

Dismantling shall be done into convenient sections, so that the weights & sizes are suitable for transport to site & for handling on the site under the special conditions of the project.

All individual pieces shall be marked with the correct designation shown on the Contractor's detailed drawings and other documents (packing lists, spare part lists, in Operating and Maintenance Instructions, etc.).

Marking shall be done preferably by punching the marks into the metal before painting, galvanising, etc., and shall be clearly legible after painting, galvanising etc. In labelling, the Contractor shall endeavour to use as few designations as possible and each part of identical size and detail shall have the same designation, regardless of its final position in the plant.

All parts shall be suitably protected against corrosion, water, sand, heat, atmospheric conditions, shocks, impact, vibrations, etc.

All electrical parts shall be carefully protected from damage by sand, moisture, heat or humid atmospheric conditions by packing them in bio-degradable packing material. Where parts may be affected by vibration, they shall be carefully protected and packed to ensure that no damage will occur while they are being transported and handled.

The material used for shipment of material frame at manufacturer’s works withstanding the above shall be preferably environment friendly. Biodegradable packing shall be used to the extent possible.

The Engineer in-Charge reserves the right to inspect & approve the packing before the items are dispatched but the contractor shall be entirely responsible for ensuring that the packing is suitable for transit & such inspection will not exonerate the contractor from any loss or damage due to faulty packing.

8.3 Marking

The Contractor shall mark all containers with the implementing document number pertinent to the shipment. Each shipping container shall also be clearly marked with following information on at least two sides:

i) Consignee
ii) Contract No.
iii) Country of Origin (if applicable)
iv) Port of entry (if applicable)
v) Item number (if applicable)
vi) Package number, in sequence and quantity per package
vii) Description of Works
viii) Net and gross weight, volume

8.4 Transport and Storage

The Contractor shall inform himself fully as to all relevant transport facilities and requirements, loading gauges and other limitations and shall ensure that the equipment as prepared for transport shall conform to such limitations. The Contractor shall also be responsible for obtaining from the Indian railway or highway authorities any permit that may be required for the transport of loads exceeding the normal gauges.

The Contractor shall provide means for all unloading and reloading for all consign-ments of plant; both during transport to Site and on the Site. Consignments shall be unloaded immediately on arrival at Site. The Contractor is required to take the necessary steps in order to provide the carriage, special supporting structures for heavy loads, etc.

All parts of the plant shall be brought, as far as possible, to their final place of erection. The Contractor shall construct their own storage facilities at site.

The warehouses shall be weather proof, with good ventilation and solid floors. The floors of the warehouses and storage areas shall be designed to carry the loads imposed on them by the stored parts. The following parts shall be stored inside enclosed warehouses:

Bolts, pins, packing, tools, insulation materials, electrical parts with electrical devices attached, electric motors and PCU inverters, instruments, welding material and equipment, all small parts and all parts of the plant which already have been finally painted.

If large parts are stored in the open air, they shall be provided with weather resistant and fire-resistant covers. Electrical parts, which are not packed suitably and those so packed, but whose packing has been damaged shall be kept in suitable places from the moment of storage to the moment of installation.

All insulation materials which will be taken from the warehouse for installation and which are stored temporarily in the station shall be protected from weather or humidity.

All the equipment shall be stored as per standard storage and preservation instructions etc. of the suppliers for long period.

8.5 Preparation and Installation

All parts of the plant shall be cleaned carefully of all contamination such as dust, sand, rust, mill scale and other dirt prior to installation.

8.6 Reference Points

The Contractor shall employ a competent surveyor for setting-out of all reference points lines including the constant checking and maintenance of the setting-out until the completion of his works.

The Contractor shall provide all necessary pegs, profiled templates and shall establish all such permanent markings and recovery marks as may be required by the Engineer in-Charge for checking the Contractor's setting-out. The Contractor shall be responsible for rectifying, at his own cost, all work rejected by the Engineer in-Charge due to errors in setting-out.

8.7 General Notes on Installation Work

All transportation and handling of the plant from the place of storage to the place of installation shall be carried out by the Contractor. He shall provide all hoisting equipment, staging and scaffolding, winches and wire ropes, slings, tackles and all other appliances and temporary materials. The erection staging and scaffolding shall be provided with coverings and barriers and shall guarantee safe working conditions.

The Contractor shall comply with all latest applicable and approved safety regulations while carrying out the works on Site and with all reasonable requirements of the Engineer In-Charge. This stipulation shall in no way release the Contractor from any obligation concerning his liability for accidents and damages. He shall be responsible for adequate protection of persons, plant and materials against injuries and damages resulting from his operations.

The plant or parts to be installed shall not be overstressed during the process of installation.

The Contractor shall be responsible that the installation of all plant is properly executed to the correct lines and levels and in accordance with the manufacturer's instructions and the Contract requirements.

Setting of parts to be aligned shall be performed by means of fine measuring instruments.

All parts to be embedded in concrete shall be set accurately in position and shall be supported rigidly to prevent displacement during the placing of concrete. Adjusting screws and bolts shall be drawn tight and secured adequately. Steel wedges shall be secured by welding. Wooden wedges shall not be used.

The Contractor shall verify carefully the position of all parts to be embedded before concrete is poured. All important measurements and dimensions shall be recorded. Copies of these records shall be given to the Engineer In-Charge for checking and approval before items are built-in to the Works.

The Contractor shall provide all necessary anchors and braces to ensure the alignment and stability of the parts to be installed. All temporary anchors and bracings shall take care of all dead load, wind load, seismic and erection stresses,

e.g., during concreting, and shall remain in place until they can be removed without endangering the stability of the plant.

If for installation purposes auxiliary structures have been attached to the plant, they shall be removed after completion of work and the surface restored to proper condition by grinding and repainting.

Modules or other parts, which can easily be damaged, shall be provided with suitable protective sheaths or coverings during installation.

The Contractor shall keep the site in clean condition during erection and commissioning time. On instruction of the Engineer In-Charge he shall remove waste from the place of installation to the defined deposit site at his own cost.

The Contractor shall level and adjust all parts of the equipment on the foundations and after each item is set up The Contractor shall be responsible for ensuring that such work is carried out to his satisfaction and that level and adjustments made by him are not disturbed by the grouting operation. The Contractor shall be responsible for ensuring that the positions, levels and dimensions of the Works are correct according to the drawings notwithstanding that he may have been assisted by the Engineer in-Charge in setting out the said position, levels and dimensions.

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EMPLOYER'S REQUIREMENT
(TECHNICAL REQUIREMENT)
ELECTRO-MECHANICAL WORKS
PART-2: PARTICULAR TECHNICAL SPECIFICATIONS

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1 GENERAL TECHNICAL REQUIREMENTS

1.1 Introduction

Particular Technical Specifications (PTS) elaborated in various sections specify the detailed technical requirements for the design, manufacture, quality assurance, quality control, shop assembly, shop testing, delivery at site, site storage and preservation, installation, commissioning, performance testing, acceptance testing, training of Employer's personnel, handing over to the Employer and guarantee for two years of the Electrical & Mechanical works covered under this contract. The quality assurance and testing requirements for each section are specified separately in "Quality assurance and Testing Specifications (QTS)".

This section provides the general technical requirements applicable to all sections hereafter specifying the detailed technical specifications for respective equipment/ system forming E&M installation of the project.

1.1.1 Completeness of System / Equipment / Item

The work to be carried out as per the scope defined in respective sections shall be all in accordance with the requirements, conditions, appendices etc. given in Technical Specifications (GTS, PTS, TDS, QTS and Contract Drawings) together with those stated in General Conditions of Contract (GCC) and Special Condition of Contract (SCC).

It is not the intent to specify herein all aspects of design and construction; nevertheless, the equipment and installation/works shall conform in all aspects to high standard of engineering, design and workmanship and shall be capable of performing in continuous commercial operation in a manner acceptable to the Employer, who will interpret the meaning of the specification and drawings and shall have a right to reject or accept any work or material which in his assessment is not complete to meet the requirements of this specification and/or applicable Indian / International standards mentioned elsewhere in this specification.

Any such system/equipment/items, which are not explicitly mentioned in specification but are functionally necessary/advisable as per best national/international practices for smooth operation of power plant, shall be deemed to be included in the scope of work and the Contractor shall provide the same without any extra cost to employer.

1.1.2 Priority of Documents

The documents forming the Technical Specifications are to be taken as mutually explanatory of one another. If there is an ambiguity or discrepancy in the documents, the Employer shall issue necessary clarification or instruction to the Contractor and the priority of the documents shall be as follows:

Particular Technical Specification,

Guaranteed Technical Particulars in Technical Data Sheets,

General Technical Specification,

In case of dispute in interpretation, Employer's interpretation shall be final and binding.

1.1.3 Co-ordination and Interfacing with Sub-contractors / Manufacturers / Vendors

The Contractor shall ensure the functional and physical compatibility of supply at each physical interface among various sub-contractors / manufacturers / vendors in order to ensure efficient, reliable and safe operation of the whole system/scheme.

The limits of the supply and the definition of interface indicated by any sub-contractor shall in no way release the Contractor from his obligation to fulfil the scope defined in specifications.

The Contractor shall ensure co-ordination among various sub-contractors, to verify the continuity and the coherence between their scopes and shall be accountable to the Employer for fulfilment of the scope defined in the specifications. The Contractor shall also resolve all interfacing requirements among various sub-contractors for execution of the work as per scope of contract.

1.2 Project Arrangement / Layout

1.2.1 Brief Description of Project

The proposed plant is a grid interactive solar photovoltaic of 200 MW (AC) capacity. The project will be set up within the 600 MW Solar Park (Stage-1) of GSECL at Khavda, Gujarat.

Contractor shall connect their power project to 400/765 kV Substation of CTU through 33/400 kV Internal Pooling Substation of the solar park to be developed by GSECL by laying 33 kV cable up to 33kV bus bar of Internal Pooling Substation.

Land for the project @1.85 Ha/MW shall be provided by Employer. The land shall be in two plots each for 100 MW Capacity.

The PV Modules and rest all other equipment's and systems up to 33kV Main Pooling Switchgear is covered under the said EPC Package.

1.2.2

1.2.2 Main Features & Design Parameters of Project

Plant Capacity (AC)	200 MW *
Plant Capacity (DC) at Standard Test Condition (STC)	272 MWp (Min)#
Annual Guaranteed Generation in the first year of O&M at Metering Point (Min Limit of quoting generation)	474 Million kWh
Annual Guaranteed Generation in the first year of O&M at Metering Point (Max limit of quoting generation)	498 Million kWh

Power Rating of SPV Module at STC (No negative tolerance)	540 Wp (Min)
Module Efficiency at STC	20.79 % (Min)
Module Mounting	Single Axis E-W Tracker[$]
Cumulative capacity of PCU/ Inverters & IDT	As per Chapter of PCU/ IDT
33 kV Pooling Switchgear	System Fault Current Rating: 25 kA for 1Sec (Min) fault Dynamic Withstand Current Rating: 2.5 times of system fault current Main/ Final Pooling Substation is in Park Developer Scope; however, Sub pooling shall be in Contractor Scope.
33/400kV Power Transformer	In Park Developer Scope
DC and LT Power cable voltage drop criteria	From Module to Inverter Transformer shall be limited to 3% of rated voltage. For all other LT cables, Maximum Voltage drop shall be limited to 3% of rated voltage.
33kV Cable Laying Methodology from project end to 33 kV Pooling Substation of GSECL	As per norm and requirement of GSECL
Basic Wind Speed for Civil & Electrical Design	170 Km/hr
Design Wind Pressure, min, Pd (N/m2)	890
Metering Point**	At 400 kV side of 400/765 kV KPS-II Substation of CTU
Licenses for Remote Monitoring of SCADA	Minimum 2 Nos for Remote Monitoring (Concurrent viewing of data at 2 different locations authorized with user ID & Password)

Time Synchronisation	At least one GPS clock, which shall be synchronized with the SCADA system and all devices which are communicating with Solar SCADA shall be synchronized with GPS Clock through SCADA or directly with GPS Clock
Power Evacuation	Through 33kV Cables upto 33/400kV indoor pooling Substation of Solar Park Developer i.e. GSECL. As per the existing arrangement shown in GSECL South block Substation SLD, power from project end to GSECL shall be transported through 2R of 3C x 630 Sq MM XLPE Al Cable. Maximum Capacity of each incoming feeder at GSECL Pooling Substation is 50 MW. Each 33kV feeder from Local Pooling to main pooling substation of GSECL shall not carry more than 30 MW capacity.
Telemetry System	The arrangement to transmit data from Solar plant to remote ends including Load Dispatch Centre (LDC) or/ and any other designated agency shall be as per extant regulation, and procedure of Grid Management and GSECL/ any other agencies requirement. Communication link and communication controller/Gateway used for data communication shall be redundant (one for normal operation and other as hot standby). All Communication infrastructure for transferring of Solar plant data and interfacing of SPV Plant SCADA with GSECL's SCADA shall be in Contractor's scope.

Module Cleaning Arrangement	Solar Modules Cleaning System shall be with water through pipe network. ***
Performance Evaluation during PG Test and O&M Period	Net Exported Energy shall be compared with Base Generation for determination of shortfall in Energy Generation on which the penalty for performance will be levied as per the procedure mentioned.

*Bidder must mandatorily limit the output of the Solar PV Plant at the Injection Point to Project Capacity (kW_{AC}) so that the Power injected into the grid never exceeds the threshold of Project Capacity.

** ABT metering arrangement shall be as per Transmission Utility/ GSECL requirement/standard.

*** Array layout shall be designed considering future provision for operating Robotic cleaning system from reputed manufacturers/suppliers. The continuous length of solar array table (or MMS) for using Robotic cleaning system, the distance between two modules of two different Array tables, required levelling and grading shall be done by the bidder. The bidder shall provide the details of compatible models of Robotic cleaning system from a different manufacturers/supplier and same shall be used in detail engineering of array layout design. Supply of Robotic Cleaning system is not in the bidder scope.

[#] Not at BSTC i.e. The above requirement of DC capacity is at STC (Front), however, Bidder can consider the bifacial module for additional energy yield for quoting annual generation.

In case bidder opt for bifacial module, the min DC capacity mentioned above shall be at STC I,e, front side

[$] Details regarding seasonal & Fixed tilt system mentioned in the Technical Specifications shall not be applicable for this package.

Outdoor Containerized Solution/Compact Substation

Outdoor containerized solution/compact substation with inverter, inverter transformer & MV/ HT Switchgear as inverter station are acceptable. However, technical specification of inverter, HT/MV switchgear and inverter transformer as per relevant chapters of technical specification shall be applicable.

Statutory Compliance, Grid connectivity and Power evacuation

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.

The Solar PV plant should fully meet the Grid Connectivity Regulation as per Central Electricity Authority (Technical Standards for Connectivity to the Grid) Regulation, 2007 with all amendments/ clarification including Central Electricity Authority (Technical Standards for Connectivity to the Grid) (Amendment) Regulations, 2019 and the report namely "Data Submission Procedure and Verification of Compliance to CEA Regulations on Technical Standards for Connectivity to the Grid by RE Generators" may also be referred to for this purpose.

GSECL shall comply for reactive power compensation required for equipment of substation only, reactive power compensation required for individual solar plant shall be in the scope of solar developers only.

Supply of redundant power plant controller (PPC) and development of solar plant model in PSS/E software as per CTU/STU (as applicable) are in the scope of the Bidder. Details control logic in the PPC shall be finalized during detail engineering stage and same shall be in line with the above regulation requirements.

The solar plant SCADA and PPC networks shall be suitably designed, so that PPC shall directly independently able to control the individual solar inverters. GSECL shall install Master Power Plant Controller (PPC) for power quality monitoring at Pooling substation end however it is responsibility of contractor to integrate with slave PPC at their end.

Suitable PQ meters at plant output for measurement of required electrical parameters (active power, reactive power, power factor, voltage, current, frequency) shall be provided for this purposed. Selected PQ meters shall be able to measure grid frequency up to two digit after decimal point

Project should be designed for interconnection at 400kV.

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 CERC, CEA, Grid India/ RLDC/NLDC, CTU/ STU, GSECL/ MNRE/MOP, other concerned agencies etc shall be deemed to be included in the scope of work of the Contractor.

PROJECT LOCATION CLASSIFICATION (CORROSION PROTECTION)

Parameter	Coastal / Non-Coastal	Corrosive Category (as per ISO12944-2)
For below Ground Structures (including up to 300mm above ground)	Coastal	C5-M
For Above Ground Structures (Beyond 300mm)	Non-Coastal	C4

Corrosive category (for Paints)

Classification of environments for Corrosive category shall be in accordance with ISO12944-2, the applicable atmospheric corrosivity categories C4 (high); C5-M (very high-marine).

ISO12944-5 shall be used related to paint systems in combination with guidance for the selection of different types of protective paint system.

Wherever specification allows LT electrical panels, UPS, SCADA panel, Fire protection panel etc. associated with Inverter station to be placed outdoor, the enclosure of the same should be well engineered product having proper ventilation system and must be protected from harsh environment & direct sunlight/rainfall. Radiation and absorption effects of outdoor environment must be considered for temperature rise calculations. The temperature rise should not be more than working temperature of components. Requirement of suitable shed/canopy shall be reviewed based on the offered solution during detailed engineering stage.

For metal enclosed outdoor HT switchgear/RMU, pooling switchgear on the LT side (if applicable) from string inverter to inverter transformer, suitable shed shall be provided considering the O&M space.

Painting of outdoor metallic enclosed electrical panels including HT switchgear/RMU shall be as per ISO 12944-5, corresponding to corrosive category mentioned in the above table.
For outdoor inverter including containerized solution, painting corresponding to site condition shall be provided.

Unless noted otherwise, all steel structures exposed to environment would be painted to meet the requirements of C4 corrosion category or would be galvanized to minimum 90microns. However, onus of protection of plant would rest with Bidder, basis detailed engineering calculations to be carried out by the bidder.

1.3 Operating Requirement / Specification

The equipment/system to be supplied under this contract shall be suitable for continuous operation under varying grid parameters as allowed in latest “Indian Electricity Grid Code” and “Indian Electricity Rule”.

The equipment/system shall be designed to operate continuously without any problem under ± 10 % voltage variation and ± 5% frequency variation. Temperature rise/ variation limit for equipment shall be determined considering the above variation. Frequent start/ stop requirement of all equipment for daily operation shall be taken into consideration while designing.

1.3.1 Auxiliary Voltages

The electrical equipment like switchboards, MCCB, Surge Protection Devices, motors, contactors, relays, luminaries, heaters, switches, sockets, Terminal Blocks, Power outlets etc. should be rated for any of the following voltages:

A) AC Power

Three-phase system with grounded neutral for feeding three-phase and single-phase equipment (connected between phase and neutral), type TN-C 415/240V ± 10% and 50Hz ± 5%. All motors and other electrical apparatus should be designed to work continuously under ±5% frequency variation and ±10% voltage variation.

B) DC Power

i) 220V or 110 V DC Systems with voltage variation ± (Plus / minus) 10%, ungrounded, with earth fault detection for the supply to main control circuits for high and medium voltage switchgear, protection circuits and to other larger essentials loads,

ii) DC systems for the supply to PLCC/OPGW/ any other means and EPABX etc

iii) Other voltage systems eventually needed, shall be generated from the above systems by means of dc/dc converters, inverters etc.

1.4 Performance Guarantee

The Contractor shall guarantee that the equipment offered shall meet the ratings and performance requirements stipulated for various equipments/ systems covered in these specifications.

The Contractor shall demonstrate all the guarantees covered herein during functional guarantee / acceptance tests. The Contractor shall conduct the guarantee tests at site in presence of Employer.

1.5 Design and Construction

1.5.1 Design Criteria

The following design criteria shall be considered mutually complementary of one another and shall be applied by the Contractor to all aspects of the equipment and services supplied under this Contract.

1.5.1.1 Maximum Allowable Stresses

A) General

Adequate factors of safety shall be used throughout the design, especially in the design of parts subject to alternating stresses, vibration, impact, or shock. The design of the equipment shall include seismic loads as specified in the clause 1.5.1.3 “seismic design” of this section.

B) Stresses in Standard Products

Standard products are not subject to the above conditions i.e. will not be custom designed. Such products are for example:

i) Drainage/ module Cleaning System,

ii) Fans,

iii) Other similar products

1.5.1.2 Deleted

1.5.1.3 Seismic Design

The bidder shall consider seismic zone III of India for designing of various project components".

1.5.1.4 Transportation Limitations

For shipments, the Manufacturer shall pack the items to meet size and weight restrictions of the Indian railways and Indian road systems.

Shipments from Manufacturer's work (in case offshore consignments) shall travel to Port of entry – India, from where these will be transported, after necessary port clearances etc., by the Contractor to nearest rail head for the Project, and further transported to site. However, in certain cases the Contractor may be required to transport the materials from Port of entry to Project site directly by road transport. For onshore consignments, the Contractor shall be responsible in all respects for transportation of all material and equipment up to the project site.

The Contractor shall consult with the concerned authorities in railways and highways to ensure that his packaging will be such as to permit him to transport the plant and equipment within such imposed limits. The Contractor shall arrange to deliver the maximum sized sub-assemblies consistent- with safe and convenient transport.

All materials and equipment etc. arrived at nearest railhead for the Project will be unloaded from rail wagons and reloaded on to road transport for shipment to project site by the Contractor.

All components shall be so designed and constructed as would enable easy assembly of components at works and at the same time permit easy transportation. The weights and sizes of the components/packages shall be within the permissible transport limits for the project site.

1.5.1.5 Equipment and Facilities Layout

The Contractor shall submit to the Employer for approval, arrangement and layout, optimised for the actual equipment supplied under this contract, respecting the key dimensions, elevations and concrete outline of the power plant.

1.5.1.6 Control and Monitoring

The system shall be integrated, controlled and monitored by the SCADA system. The details of control and monitoring requirement are defined in "Control and Monitoring System" and "Protection System" Chapters.

The control by the SCADA system shall be through Main Control Boards/Local Control Boards. All information that is necessary for comprehensive, convenient and selective control and monitoring of the system by the SCADA system shall be transmitted through Main Control Boards/Local Control Boards. The Main control Board and local control boards shall be provided with surge protection device.

The surge protection device shall be tested with IEC 61643-1. The surge arrester shall be pluggable type and should have indication for life.

It shall be the responsibility of the Contractor to make all necessary provisions required to achieve seamless and compatible interfacing of control and monitoring systems of complete plant SCADA system.

Provisions of all transducers/ sensors, instruments, gauges for mechanical parameters (temperature etc.) and electrical parameters (current, voltage, frequency, power, MVAR, KWH, etc.) and spare contacts of relays, breakers, isolators push buttons, control/selector switches etc. from various equipments for monitoring, alarm, annunciation, control function etc. through plant SCADA system are in the scope of this contract.

Interconnection from various equipment to Local Control Cubicles and Control Boards and all necessary interfaces, like I/O modules, PLCs, CPUs etc., required for communication between local panels/Local Control Cubicles of various auxiliaries/ equipment and respective Local Control Boards shall be covered under scope of this contract.

For connecting marshalling box/junction box with various equipments in field, multi-pin plug connector system shall be used, if feasible. The contact carriers shall have two capacitive PE contacts each to give the proper earthing to the system and it shall be suitable for electrical data equivalent to 250V/10A. The contact type shall fulfil the requirement of IEC 60 352/ DIN EN 60 352. The contact carriers shall be covered by housing made up of polyamide 6.6 of V0 in flammability class in accordance with UL 94 and fulfil the requirement of IP65 at least. The housing shall be directly sealable on the mounting wall without the need of any kind of wall mounting base. The complete arrangement shall be highly reliable even under harsh conditions, due to high degree of protection."

Local control shall be performed in a standalone manner independent of SCADA system, and all information (faults, alarms, measurements, status) necessary for such control shall be displayed locally. Provision of control selector switch for selection of control through Local Control Cubicle, Local Control Board and plant SCADA system shall be made in Local Control Cubicles and Local Control Boards.

If the system consists of redundant subsystems, the priority of operation of such subsystems shall be selectable, either from SCADA system or locally.

1.5.1.7 Power Supply for Control and Monitoring

A reliable surge protected power supply shall be provided for powering the electronic circuits of the equipment/component. The power supply shall be from two independent DC station battery source, one as primary and other as secondary. Switchover from primary to secondary will follow automatically on failure of primary and return to the primary source automatically following restoration of primary supply. The primary source of supply and the charger of the battery should be protected with surge protection device. The surge arrester should be pluggable type and should have indication to show its life.

The power supply shall include redundant converter (dc-dc) connected to station battery source such that failure of any regulated output voltage shall cause instantaneous transfer to a redundant converter without affecting normal operation of the equipment/component in any way. Contacts shall be provided to alarm on power supply failure and local indication shall be provided to identify the failed functional block. The Contractor shall provide full details of the proposed power supply system for approval by the Employer.

In case AC supply is required for any control function, same shall be sourced from two Inverters, with one main and other standby and with automatic change over facility.

1.5.2 Colour Schedule

Colour standard references to major equipment / system shall be as mentioned in **Annexure-I**. The interior of all cubicle and panels shall preferably have a matt white finish unless specified otherwise.

1.5.2.1 Electrical Equipment Enclosures

Unless otherwise specifically called for or described in these Contract documents all electrical appliances shall conform to the applicable IEC Publications.

The cubicles and enclosures shall be of protection class IP 40 or higher according to their location.

For outside installation and area which are humid, corrosive, and prone to dripping and/ or spray of water, the protection class of cubicles shall be IP 65. Cubicles housing electronic cards/modules shall be of protection class of IP 5X.

Cables shall have at least 1100 V PVC insulation except for 220V DC/110 V DC and tele-metering or communication system equipment for which 650V and 300 V ratings respectively are acceptable.

Wiring shall terminate at terminal blocks at one side only. Where tap connections are required, they shall be made on terminal blocks. Wiring shall be neatly arranged and laid in wire ways accessible from the front door. The wire ways shall not be filled more than 70 %.

Each cubicle shall be provided with an earthing bar (PE) of sufficient cross section carrying any possible fault current without undue heating. All metallic parts of the cubicle not forming part of the live circuits, all instrument transformer terminals to be earthed and other earthing terminals as well as all cable screens and PE-wires shall be connected to the earthing bar.

All internal equipment and wiring shall be neatly and clearly marked as indicated on the schematic and wiring diagrams. Internal wiring and cables shall be marked with sleeve type engraved marking. Marking system and marking material shall be subject to approval by Employer. Identification of the respective conductors shall be in accordance with the requirements of IEC publication 60204. In cable, having five conductors or more the individual conductors shall be numbered throughout the entire length. In cables having less than five conductors colour coding in accordance with IEC Recommendations 60204 shall be used.

1.5.2.2 Terminal Blocks

Control circuits and power circuits shall be completely separated by use of divided or separate terminal blocks

The screw type modular Terminal Block should be manufactured as per IEC-60947-7-1. The insulating material of Terminal Block should be of polyamide 6.6 meeting VO/V2 in flammability Class as per UL94. All metal parts including screws should be of copper alloy. The Terminal Block should be suitable for mounting on both 'DIN' as well as 'G' type rail. All the metal parts should be captive and touch proof. The Terminal Block should have screw locking design so that it can withstand vibration level up to 5g and also prevent accidental loosening of conductors. The terminal blocks shall also have necessary accessories like end clamp, separation plates etc.

Unless otherwise specified terminal blocks shall be suitable for connecting the following conductors on each side.

1	All circuits except CT /PT circuits	Minimum of two of 2.5 sq. mm copper flexible
2	All CT/ PT circuits	Minimum of 2 nos. of 6 sq. mm (For CT) & 4 sq mm (For PT) copper flexible

At least 20% spare terminals shall be provided on each panel/ cubicle/ box and these spare terminals shall be uniformly distributed on all terminals rows.

1.5.2.3 Control switches, Indicating Lamps and Instruments

A) Measuring Converters

The converters shall be suitable for direct connection to the secondary circuits of the potential and current transformers used, or other sensors, each as they apply. The converters shall be static type, having all accessories to provide an output signal of 4-20 mA, filtered DC.

For the measuring converters the following minimum requirements shall be fulfilled:

i) Current transducers shall be single-phase, of accuracy class 0.2 or better.

ii) Voltage transducers shall be single-phase of accuracy class 0.2 or better.

iii) W and VAr transducers shall be two elements, three-phase. Accuracy class of the transducers shall be 0.2 or better.

B) Measuring Transformers

Potential transformer secondary windings shall be rated 110/√3 V

Current transformer secondary windings shall have a rated current of 1A/2.5A /5A.

1.5.2.4 Cautionary Signs

Caution and warning signs must be displayed in English, Hindi and local language.

Identification plates and instruction plates shall preferably be bilingual i.e. English and Hindi/ Local language.

1.6 Record and Documentation

1.6 Record and Documentation

1.6.1 Documentation / Record of Work/Activities

The documentation/ records of the work under this contract for future reference shall be included in the scope of work.

The Contractor shall document all the major activities, milestones related to installation of power plant from commencement of work under this contract and shall maintain the documentation/record in chronological order till the completion of the job specified under the contract.

The Contractor shall submit five copies of above documentation/records to the Employer after completion of work under this Contract. The Contract shall be deemed as completed only after the Contractor submits the same.

1.6.2 Design Memorandum

The Contractor shall prepare and submit to the Employer a “Design Memorandum” of the proposed equipment/system fulfilling the contract specification/requirement given in respective section for approval prior to submission of any drawings and documents. The memorandum shall include the design philosophy, methodology, system description, input parameters for design, standard and codes, design and selection criteria, equipment data, material specification, major technical features, basic arrangement/ layout etc.

Design memorandum of all the equipment / system shall be prepared and first draft shall be submitted within one (1) months from date of award of the contract.

1.6.3 Technical Documentation

All the technical documents and drawings required to be furnished under this contract as per clause of “General Technical Specifications (GTS)” shall be prepared in internationally accepted software of latest version used for preparation of documents and drawings.

The Contractor shall submit six (6) copies (or as required) of drawings along with copy in electronic form media for approval / review as per clause of “General Conditions of Contract”.

At the time of completion of contract, the Contractor shall submit five copies along with two reproducible and five copies in electronic form for permanent storage, of approved and as built drawings together with operation and maintenance manual as specified in elsewhere in bid document.

All the drawings and documents shall be submitted in presentable folders properly bound and catalogued for easy retrieval / reference. Drawings shall be submitted in A0 / A2 /A3 and all documentation in A4 size. All drawings shall be digitally printed/ plotted. Ammonia print/ blue print shall not be accepted.

The schedule for submission of the following drawings/documents will be discussed and finalized with the successful Bidder.

i. List of drawings and documents along with schedule of submission

ii. Design calculation for the selection of solar PV modules / panels /arrays with loss diagram and site area occupation statement.

iii. MAP showing the results of pre-construction survey including topographical survey for the proposed area of the Solar PV power plant

iv. Plan General Layout of Solar PV Power Plant including substation, module yard, internal roadways, live fencing areas, outer fencing, gate, drainage system and water distribution system.

v. Elevation and sections of the typical solar PV panel / array support structure showing the levels, orientation, clearances and inter distances.

vi. Details of power conditioning unit/inverter (Bill of Materials, Schematic diagram, Wiring diagram, Internal layouts etc)

vii. Design calculations for module mounting structure, Tracking System (if applicable) etc

viii. Design calculations for indoor / outdoor lighting.

ix. Design calculation for UPS and battery sizing.

x. Schematics for Fire Detection and Alarm System.

xi. General Arrangement, schematics and data sheet for string combiner system.

xii. General Layout of earth pits in the yard for lightning protecting and equipment earthing.

xiii. General arrangement and schematics for lightning protection system for buildings and arrays.

xiv. General routing, section and termination diagrams for power / control / automation cabling.

xv. General arrangement and schematics for water system.

xvi. General Equipment Layout drawing for Main Control Room showing Switchgear room, SCADA room, Office, stores, pantry, toilet, parking and security cabin.

xvii. Technical specification / data sheets for all items covered under scope, GA drawings for inverter, transformer, bus trunking, junction boxes, control panels, breakers, isolators, cable trays etc

xviii. GA drawings and data sheets for DC battery, charger, UPS,

lighting fixtures, air conditioners, fans, etc.

xix. Block diagram, schematics, bill of quantities and data sheets for Surveillance camera system and desk.

xx. Design assignment / data sheet and GA drawing for civil foundation design of solar PV module array footings, building foundations, fencing, gate and watch towers, etc

xxi. Quality assurance plan

xxii. Performance guarantee parameters and demonstration procedures

1.6.4 Quality Assurance Plan

Bidder shall submit a model Quality Assurance Plan (QAP) for facilitating quality assurance and inspection indicating the latest practise and procedure of all the equipments covered in this volume at the time of submission of Bid.

1.6.5 Type Test

During detailed engineering, the contractor shall submit all the type test reports for SPV Modules, String Combiner Box (SCB), PCU/ String Inverter, LV/MV/HV Switchgears & breakers, Outdoor Switchyard equipment (If applicable), Cables (DC& AC), Transformers etc carried out within last ten years from the date of techno-commercial bid opening 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 requirement, the contractor shall conduct all such tests under this contract at no additional cost to the owner either at third party lab or in the presence of client/owner's representative and submit the reports for approval.

1.7 Delivery, Installation and Commissioning

1.7 Delivery, Installation and Commissioning

1.7.1 Packaging, Handling and Site Storage

The Contractor shall follow the general requirement of Packaging, Handling and Storage elaborated in "Section 8 - Transport and Installation" of "General Technical Specification (GTS)".

The Contractor shall pack all the consignment in sea worthy packaging, wherever required, strong enough to withstand rough handling during transit. Machine surface shall be suitably protected against scratches, corrosion, shocks, impact etc. Packages shall be suitably and distinctly identified for type of handling and kind of storage.

The packaging and storage of electronic equipment shall be strictly in accordance with internationally accepted standards. Electronic equipment shall be packaged, shipped and stored in anti-static packing. All packages shall be stored indoor. Packages containing electronic equipment shall be stored in humidity-controlled environment. Cost of all the packaging materials/scraps thereof will be deemed included in the supply.

1.7.2 Installation

The Contractor shall follow the requirements of installation elaborated in "Section 8 - Transport and Installation" of "General Technical Specification (GTS)".

The Contractor has to do all the work related to assembly, erection, testing and commissioning complete in all respects. All necessary tools, plants, labour, materials including consumables for performing installation, testing and commissioning shall be provided by the Contractor.

The Contractor shall submit the necessary data/information, layout and foundation/support drawings well in advance.

The Contractor shall provide and install the concrete inserts/embedment; support steels and/or components for foundation/supports purpose as per approved erection drawings and coordinate the activities in synchronism with civil work. All installation for foundation shall be verified and accepted by the Employer.

The Contractor shall use anchor fasteners for installation of piping, fixtures, mountings, conduits, cabling, panels etc. Chipping of concrete and/or taking support from reinforcement bars shall not be allowed.

The design, location and approval tests of anchoring rings for the fixing of lifting apparatus necessary for assembly and dismantling of equipment and plant accessories shall be the responsibility of the Contractor.

1.7.2.1 Installation Procedure

The Contractor shall submit six copies of all detailed programs and the procedures to be adopted for erection / installation, testing and commissioning well in advance, before start of erection activities/ installation, for approval of the Employer.

The installation procedure shall also have a section "site quality assurance plan" containing erection data sheets for various components. These sheets should specify site measurements/ inspections required to be made for ensuring proper installation.

1.7.2.2 Field Welding

The Contractor shall select the proper filler material with respect to parent material for all field welded connections and shall specify it on the applicable drawing, together with the detail design of the field weld joint.

All cutting, chamfering, and other shaping of metals necessary for the field connection shall be done as far as possible in the shop. Adequate

temporary bolted field connections shall be provided to hold the assemblies rigidly and in proper alignment during shop and field assembly.

1.7.2.3 Cable Laying

Wiring between equipment enclosures shall be made with cables, laid in trenches and/or cable trays and in cable conduits. The Contractor shall submit for review to the Employer a cable route layout-showing location of trenches, conduits and trays. All material for cable laying such as cable trays supports and fastening material shall be furnished and placed by the Contractor. Cables shall be properly fastened and marked where they enter enclosures by either cable clamps or nipples.

Cables in horizontal cable trays shall be fastened properly with clamps or plastic strips. Power and control cables shall be placed in separate trays or conduits. Cables shall be clearly marked at each terminal point.

1.7.2.4 Embedded Parts and Anchor Bolts

All embedded anchor bolts, rods, welding plates and support plates shall be provided. Anchor bolts shall consist of a threaded steel rod installed inside a pipe sleeve to provide lateral adjustment after the sleeve is embedded. The embedded end of the rod shall be provided with a steel plate, which shall be welded to the rod and sleeve to provide anchorage and to prevent entry of concrete into the sleeve during installation.

The threaded end of the rod shall be provided with two steel nuts and two steel washers to permit levelling and anchoring the equipment prior to grouting. Approved types of expansion or chemical anchors shall be used where practicable for small equipment.

1.7.2.5 Installation Records

The Contractor shall maintain the installation records including installation quality control (QC) records of each activity to ensure quality of installation as per specification/requirement. The QC record shall clearly show the achieved erection tolerances vis-à-vis the allowable limits. The installation records shall be submitted to Employer for approval/ acceptance to establish completion of installation milestones as per program of performance. All installation records shall be compiled and submitted to the Employer before taking over the plant. Completion certificate for any work shall be issued only after approval / acceptance of complete installation records.

1.7.2.6 Field Inspection

The Contractor shall permit Employer to perform inspections of the assembly which will include a complete verification of the assembly of all parts as to their levels, clearances, pertinent fits, alignments and quality of workmanship. The field supervisor of the Contractor shall provide Employer with three (3) copies of all the clearances, tolerances and data of all pertinent fits, alignments and levels, so that the latter may repeat the Contractor's measurement, if desired.

Unless otherwise specified, any rejection based on the inspection will be reported to Contractor within fifteen (15) days and injurious defects subsequent to assembly and acceptance will be rejected.

1.8 Spare Parts

The Contractor shall supply the specified and recommended spare parts as defined in "Section 3 – Spare Parts and Tools" of "General Technical Specifications (GTS)".

In addition, the Contractor shall supply sufficient number of erection and commissioning spares based on their experience so that erection, testing and commissioning work progresses smoothly and is not hampered for want of such spares.

Wherever quantity has been specified as percentage (%) the total quantity of mandatory spares to be provided by the bidder shall be the specified percentage (%) of the total population required to meet the specification requirements. In case the quantity of mandatory spares so calculated happens to be a fraction, the same shall round off to next higher whole number.

In case the main population of any item is only one no., then the spare quantity shall also be one no. overriding the requirement indicated above.

Wherever quantities have been indicated for each type, size, thickness, material, radius, range etc. these shall cover all the items supplied and installed and the breakup for these shall be submitted in the bid.

In case spares indicated in the list are not applicable to the particular design offered by the bidder, the bidder should offer spares applicable to offered design with quantities generally in line with approach followed in the above list during the detailed engineering stage/drawing approval.

In case the description/quantity for any items mentioned in the price schedule is at variance from what has been stated in the technical specifications and its subsequent clarifications the stipulations of the technical specification and its subsequent amendment and clarification shall prevail.

Identification: Each spare shall be clearly marked and labelled on the outside of the packing with its description when more than one spare part is packed in single case, a general description of the contents shall be shown on the outside of such case and a detailed list enclosed. All cases, containers and other packages must be suitably marked and numbered for the purpose of identification.

The spare parts provided by the Contractor shall be of the same quality and have the same mechanical and/or electrical properties as the original parts and be fully interchangeable with them. If modifications are made to equipment during erection, the Contractor shall ensure that these modifications are also made to all spare parts.

Conditions for tests, surface treatment, painting, etc., stipulated for the main items / equipments in the GTS/ GTR/ PTS, shall also apply for their spare parts.

Spare parts shall be conditioned, packaged, shipped and stored to ensure long term storage without degradation.

The complete set of the spare parts for the works or a section shall be delivered prior to taking over.

1.9 Tools and Instruments

1.9.1 Special tools

Special Tools shall be supplied by the Contractor as necessary for erection, installation, operation and maintenance, etc. of each item of equipment supplied under this Contract.

Special tools shall include tools specified by the Employer and those others recommended as necessary and accepted at the time of award of the contract.

All special tools shall be clearly marked to identify their use and shall be made available for the erection to be undertaken by the Contractor. Special tools shall be shipped with the first consignment of equipment to be erected.

The tools shall be delivered to the Employer prior to taking over, in perfect condition or be replaced, if necessary, with new tools of equal or better quality than the original ones.

1.10 Training

The Contractor shall arrange training to familiarize the employer's personnel about constructional and O&M aspects of equipment wherever need of specialized training is felt during detail engineering. Cost of such training shall be borne by the Contractor.

Travelling and living expenses, of the personnel deputed on such training, however, shall be borne by the Employer.

Besides above, the Contractor shall hold training sessions to familiarize the Employer's personnel with all aspects of operation and maintenance of the plant and sub-systems before the beginning of the pre commissioning tests on site. The technical documentation used in the training sessions shall include the Contractor's draft operation and maintenance manuals and test procedure descriptions approved by the Employer.

The Contractor shall provide training for each phase of work as per details agreed at the time of award.

1.10

1.10.1 Deleted

1.10.2 Training of Employer's Personnel

The scope of service under training of Employer's engineers shall include a training module covering the following:

1.10.2.1 Training during the Erection / Installation / Testing & Commissioning

Independently from the supervision and inspection functions of the Employer's Representative, the Contractor shall authorise the Employer's Personnel to follow the erection / installation / testing & commissioning and site work at his site.

The Employer's Start-up Personnel shall take no part in the equipment erection and/or installation operations, which shall be exclusively carried out by the Contractor and under his entire responsibility.

This onsite training shall cover each phase of erection / installation / testing & commissioning and shall be of sufficient duration.

The Contractor shall supply the information or measurements concerning the erection requested by the Employer's Representative or/and by the Employer's personnel.

The Contractor shall also provide on the-job training in the operation and maintenance of the Works to the Employer's Operating Personnel. Its scope and quality shall be such as to provide the trainees with comprehensive understanding of all operational and maintenance aspects of the work. Such training shall also include safety and environmental protection aspects applicable to the work.

1.11 PERFORMANCE GUARANTEE (PG) TEST

The Performance Guarantee (PG) test shall be conducted for consecutive three months by the Contractor in presence of the Employer. The start date shall be mutually discussed and agreed between owner and the bidder and the same shall be within two months from the date of successful commissioning of SPV Plant of full Capacity.

Complete SPV Plant shall be deemed to be successfully erected & commissioned after successful completion of trial run and acceptance by owner, issuance of relevant commissioning certificate from owner and State Nodal Agency/ State Transmission Company. Successful Bidders shall have to provide a written notice to GUVNL well in advance for the same.

During the trial operation, SPV plant shall perform trouble-free operation for cumulative 24 hours during which functionality of all plant components shall be demonstrated and the system shall be in Generating Mode.

The PG test procedure shall be submitted by the contractor to employer for approval. 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.

The procedure for PG demonstration test shall be as follow:

a) Minimum three (3) calibrated Pyranometers (already in scope of meteorological instrument chapter) shall be installed by the

contractor at mutually agreed locations by the contractor and employer. The output of these Pyranometers for entire life of the project including the PG test period shall be made available at SCADA. Periodical calibration of Pyranometers shall be carried out during entire contract period (O&M period) as per the calibration schedule mentioned elsewhere in the bid document and records have to be maintained by the contractor for total contract period.

b) In addition to the three pyranometers to be supplied under the scope of work, the contractor shall install one more calibrated pyranometer at horizontal plane at location mutually agreed by contractor and employer. The additional pyranometer shall be free of cost on returnable basis and the same may be removed after completion of PG Test. The output of the said pyranometer shall also be made available to the SCADA. A valid test reports for the installed pyranometers shall be submitted by the Contractor for acceptance to the employer. Contractor shall also install data logger (already in scope of meteorological instrument chapter) to store all the pyranometers data during test period. The reading of the permanent GHI pyranometer installed in the weather station will be considered for PG test. In case the data of this pyranometer is absent/not valid for any specific time stamp (maximum upto 10 consecutive time stamps (i.e; per minute readings), the data of the additional PG pyranometer will be considered/substituted for that period. However the satisfactory functioning of both these pyranometer is mandatory throughout the PG test.

c) The Monthwise data of global horizontal solar insolation (GHI) is given in the “Monthwise Radiation and Generation” format provided with the Technical Data Sheet (TDS).The Bidder is required to quote annual Minimum Guaranteed Generation (MGG) in the price schedule and also in the format of “Monthwise Radiation and Generation”. The bidder shall also quote month wise targeted generation against the quoted annual MGG in the same format i.e. “Monthwise Radiation and Generation”.

d) The Net Exported Energy shall be compared with the “Base Generation” for arriving at the shortfall of energy during PG Test Period including O&M period on which the penalty for performance will be levied. “Exported Energy” from the Solar PV Power Plant supplied by the Contractor shall be noted monthly for O&M period including PG Test period. The procedure for computation of Base Generation and shortfall in net exported energy in reference to base generation during PG test is detailed in **Annexure- II** enclosed with the specification**.** For this purpose, the Net Energy (Exported) shall be computed as per the following formula:-

Net Exported Energy = (Energy Exported from Solar Plant – Energy Imported from Grid)

The imported as well as exported energy shall be measured at metering point.

Following factors shall be considered while computing the “Base Generation”

i) Actual radiation at site

ii) Effect of any meteorological parameters shall not be considered except of solar radiation (GHI).

iii) Generation loss due to grid outage: the measured global solar radiation (GHI) of the period for the outage of the power evacuation system shall be excluded to calculate average global solar radiation for the month and the test shall be extended for the same outage duration.

iv) Outage of Equipment: - Regarding outage of any plant equipments during the PG Test period of three months, the test shall be extended for the same duration. Maximum cumulative extension of PG Test Period against this clause will be up to 03 days (72 hours). The proportionate measured global horizontal solar radiation (GHI) during the period of outage shall be excluded to calculate average GHI for the month as per method given below. For calculation of outage duration prorata adjustment of equipment capacity under outage to total capacity of the plant will be considered.

For Example: if M capacity equipment is under outage for Y hours, the outage duration considered under this clause will be (M/ Plant Capacity) x Y hours.

Similarly, Exclusion of measured GHI for the period of equipment outage shall be calculated as follows:-

(Capacity of Outage Equipment/ Plant Capacity) x Measured GHI during outage

e) If the difference of reading between the two horizontally mounted pyranometers (i.e. GHI measuring 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).

f) If the plant is not able to achieve the 'Base Generation' during the PG Test period, then contractor shall be given one more chance to demonstrate the PG test. The maximum period of 15 days shall be given to contractor to carry out the necessary modification/ replacement and restart the PG test. The steps for the PG test shall be repeated again as above after carrying out necessary modification / replacement. If the plant is not able to achieve the 'Base Generation' even after repeating the PG test and there is a shortfall in Generation, then the contractor will compensate employer with an amount equivalent to the loss in revenue as per terms & conditions specified in the GCC/ Elsewhere in bid document.

1.12 SCOPE OF OPERATION & MAINTENANCE (O&M) WORK

1. The Contractor shall be responsible for all the required activities for optimum energy generation, successful O&M of the Solar PV Power Plant and the associated power evacuation arrangement covering:

a. Deployment of Engineering and supporting personnel and regulation of their duties.

b. Deployment of Security personnel and regulation of their duties.

c. Successful running of Solar PV Power Plant for optimum energy generation.

d. Monitoring, controlling, troubleshooting, calibration of meters/instruments, testing of relays, oil filtration of transformers etc, maintaining of records and registers.

e. Maintenance of remote telemetry system including link maintenance and data transmission etc.

f. Supply of all spares, consumables for regular operation & maintenance (O&M) of the Solar PV power plant including associated equipment e.g. SPV array yard, Inverters / PCUs, LT & HT equipment including cables, transformers etc.

g. Area housekeeping on day-to-day basis of Plant facilities

h. Maintenance of Control Room, Green Belt Area etc.

i. O&M of all Access Road, approach Road, Peripheral road, Street Lighting, Ware Houses, Module Cleaning System etc

j. Repair/ Replacement & re-installation any defective equipment of the plant including transmission line at his own cost as required from time to time during the entire contract period (O&M period).

k. Supply of all types of consumables for taking use in maintenance works shall be as per recommendations of the equipment manufacturers throughout the contractual O & M period.

l. Bidder has to take Comprehensive Annual Maintenance Contract (AMC) from Original Equipment Manufacturer (OEM) or OEM authorized service provider for a period of 10 years for the following components:

- PCU System
  Replacement of spares like inductors, capacitors, electronic cards as per OEM recommendations
- SCADA & PPC system
- Tracker system
- Robotic Cleaning if offered.

Comprehensive AMC shall include all preventive maintenance and breakdown maintenance including replacement of any component to ensure that equipment is working satisfactorily as per design/system requirement. During AMC period, the OEM or its representative are required to visit at least once a year or as per OEM recommendation cycle for periodic maintenance. During AMC period, the OEM is required to respond within one working day through telecom or any electronic mean. In case of breakdown of the system, OEM has to send their representative within 72 hours. For the minor faults not hampering the generation e.g.communication, display etc., the OEM has to get the fault rectified within 7 working days. Failure from the

OEM to adhere the activity and the time schedule may lead to BG encashment.

m. Conducting periodical checking, testing, over hauling and preventive maintenance works.

n. Module cleaning of the plant as per approved schedule.

o. Daily General up-keeping including cleaning of all equipment, building, amenities, roads, Solar Photovoltaic area etc.

p. Submission of periodical reports to employer on the energy generation & operating conditions of the SPV Power Plant.

q. Taking care of the full security aspects of the SPV Power Plant & Park.

r. During O&M period, Owner's personnel shall have unrestricted entry to the solar plant and Control Room any time. Owner may suitably depute its personals to associate with O&M activities. Contractor shall assist them in developing expertise through their day-to-day O&M activities. All records of maintenance must be maintained by the contractor which can be accessed by OWNER on demand. These records are to be handed over to OWNER after the O&M period of contract.

2. Operation and Performance Monitoring

2.1 Operation part consists of deputing necessary manpower required to operate the Solar Photovoltaic Power Plant at the optimum capacity. Operation procedures such as preparation to start up to synchronization, routine operations with safety precautions, monitoring of Solar Power Plant etc. shall be carried out as per the manufacturer's instructions to have trouble free operation of the complete system.

2.2 Daily work in the Solar Photovoltaic Power Plant involves logging of the operating parameters e.g. voltage, current, power factor, power and energy output, down time of the solar Power Plant. The contractor note down failures, interruption in supply and tripping activated by different relays, reason for such tripping, duration of such interruption etc. The other task to check Station battery voltage – specific gravity and temperature.

2.3 Tilt angle changing (if applicable) as per the schedule approved during detailed engineering.

2.4 Cleaning of the plant including array yard, drains, cable trenches, box culverts etc on regular basis or as when required.

3. Maintenance

3.1 The bidder shall carry out the periodical / plant maintenance as given in the manufacturer's service manual.

3.2 Regular periodic checks of the Modules, PCU's/ String inverters and

other equipment shall be carried out as a part of routine preventive maintenance.

3.3 In order to meet the maintenance requirements stock of consumables are to be maintained as well as various spare as recommended by the manufacturer/industry practise.

3.4 Particular care shall be taken for outdoor equipment to prevent corrosion. Cleaning of the junction boxes, cable joints, insulators etc. shall also be carried out at every month interval.

3.5 Resistance of the earthing system as well as individual earthing is to be measured and recorded once in every six months. If the earth resistance is more than 1(one) ohm, suitable action is to be taken to bring down the same. Individual pit as well as grid earth resistance value alongwith date of measurement shall be displayed on each earth pit as per norms.

3.6 A maintenance record/ history sheet register is to be maintained by the contractor to record the regular maintenance as well as any breakdown maintenance works carried out along with reasons thereof etc.

3.7 Bidder is required to maintain adequate O&M spares, consumables testing kits, and tools during the O&M contract period of the solar PV Plant with a view to maximize availability of the plant. In order to meet the emergent requirements, contractor, with the permission of Employer can utilize the mandatory/ specified spares being supplied under the contract. However, the contractor shall have to return/replenish the spare of the matching quality and rating within shortest possible time.

3.8 The bidder shall Check growth of vegetation and defertilize areas with vegetation that could eventually create shade on the arrays or increase the risk of fire. Check the growth of vegetation in the microwave / infra-red barriers lines and defertilize/ herbicide it to prevent it from causing false alarms. Grass cutting in periodic basis.

3.9 The Schedules shall be drawn such that some of the jobs other than breakdown, which may require comparatively long stoppage of the Power Plant, shall be carried out preferably during the non-sun period.

3.10 The contractor shall deploy Plant In charge, adequate no of technical support staff and other supporting personnel during O&M period at Solar Photovoltaic Power Plant.

3.11 The Successful bidder shall attend to any breakdown jobs immediately for repair / replacement / adjustments and complete at the earliest working round the clock. During breakdowns (not attributable to normal wear and tear) at O&M period, the bidder shall immediately report the accidents, if any, to the Engineer In Charge showing the circumstances under which it happened and the extent of damage and or injury caused.

3.12 The bidder shall at his own expense provide all amenities to his workmen as per applicable laws and rules.

3.13 The bidder shall ensure that all safety measures are taken at the site to avoid accidents to his working personnel and employers Workmen as per relevant statutory regulation. The contractor shall comply with the provision of all relevant Acts of Central or State Government related with operational of plant.

3.14 If negligence / mall operation on the part of the O&M personnel results in failure of equipment such equipment shall be repaired replaced by bidder at free of cost.

3.15 Replacement of equipments/spare parts/ updation of software being phased out or not being supported by OEM's are also included in bidder's scope.

4. Methodology for Determination of Shortfall in Generation during O&M Period

i) The grid interactive Solar PV Power Plant shall be designed such that the net exported energy from the plant is not less than the guaranteed (Base) generation (calculated as per Annexure-III) by the bidder in the first year of O&M Period.

For subsequent years (2^{nd}, 3^{rd} ..... 25^{th}) of O&M Period, the annual guaranteed energy shall be calculated by considering Module Correction Factor (MCF) for performance degradation of modules i.e. @ 0.7 % every year.

Module Correction Factor (MCF) = 1- (Year of Operation-1) X 0.007

ii) In case there is shortfall in generation during the PG Test, Performance Guarantee Factor (PGF) shall also be applicable in calculating the annual guaranteed energy.

Performance Guarantee Factor (PGF):-

PGF = Achieved Generation during PG Test Period (Measured Net Exported Energy) / Base Generation during PG Test Period

It shall be always less than or equal to 1(one), if contractor has not met their guaranteed generation during the PG Test. Its maximum value shall be 1 even if generation achieved during PG Test is more than guaranteed generation

iii) Grid Outage/ unavailability in a year: Shortfall of energy due to the grid outage (beyond 50 hrs in a year, only period from 8 AM to 6 PM to be counted) not attributed to the contractor shall be excluded for arriving shortfall of generation. The radiation (GHI) during this period will be excluded and base generation derived accordingly. Grid Outage/ unavailability upto 50 hrs shall be to Contractor's account.

iv) The net exported energy shall be measured at Metering Point.

Net Exported Energy = (Energy Exported from Solar Plant – Energy Imported from Grid)

v) Base Generation" for a month is computed by correcting the quoted month wise generation by the bidder in the Monthwise Radiation and Generation format provided with Technical Data Sheets (TDS) with

factors MCF,PGF and measured Average Global Horizontal Solar Insolation (Methodology given in **Annexure-III**).

vi) The measured value of Net Exported Energy shall be compared with the "Base Generation" for arriving at the shortfall for the month. The procedure for computation of shortfall in Net Exported Energy in reference to Base Generation is detailed in **Annexure-III** enclosed with the specification.

5. Quality Spares & Consumables

In order to ensure longevity & safety of the core equipment and optimum performance of the system, the bidder shall use only genuine spares of high quality standards.

6. Tools and Tackles

The bidder shall arrange for all the necessary tools and tackles for carrying out all the maintenance work covered under the contract.

7. Security Services

The successful bidder has to arrange proper security system including deployment of security personnel at his own cost for the check vigil for the Solar Power Plant. The security staff may be organized to work on suitable shift system for proper checking & recording of all incoming & outgoing materials, vehicles that shall be maintained. Any occurrence of unlawful activities shall be informed to employer immediately. A monthly report shall be sent to employer on the security aspects. Any loss or damage on account of security lapse shall be compensated by the bidder.

8. Transmission Line Operation & Maintenance

Not applicable for this package.

9. Handing Over & Taking Over

On successful completion of Operation and Maintenance period, the operational plant(s) and equipments will be handed over to the employer in completely healthy and safe condition without any pending defect. During the handing over of the plant(s), the Contractor shall submit the following to consider final closer of contract**.**

- All as-built Drawings
- Technical document with detailed specification, test results for all deliverable items, Operation & Maintenance & Safety Instruction Manual and other information about the project.
- Plant performance report for the entire contractual O & M period along with complete maintenance record
- All specified/mandatory spares, tools & tackles in healthy condition as per contract. The items supplied by employer on returnable basis, such as spares parts, consumables, tools and plants, documents etc. shall be returned back to employer.
- Bill of Material

After O&M period, Employer may at its discretion decide to extend the existing O&M contract on mutually acceptable terms & conditions or undertake the O&M of the SPV Plant on its own.

ANNEXURE-I

STANDARD PAINTING SCHEDULE/ COLOUR GUIDELINES

SI. NO.	DESIGNATION	COLOUR	REF. COLOUR
1	Fire Fighting Pump , Filters	Red	RAL 3000
2	LCC For Fire Fighting Pumps	Pearl White With Fire Red Band	RAL 1013
3	Oil Purifying System (Tank, Pumps etc.)	Orange	RAL 2000
4	Water Piping	Green	RAL 6029
5	DC Boards, Invertors, Charger	Pearl White	RAL 1013
6	Marshalling Box	Pearl White	RAL 1013
7	Illumination Board	Pearl White	RAL 1013
8	Low Voltage Boards, Distribution Boxes, Starter Panels Etc.	Pearl White with Melon Yellow band	RAL 1013
9	Protection Panel / Distribution etc.	Pearl White	RAL 1013
10	33 kV Switchgear	Pearl White with dark brown band	RAL 1013

Note:- Colour schedule mentioned on the relevant drawings of the equipment shall be reconfirmed from Employer during detail engineering.

Annexure-II

COMPUTATION OF SHORTFALL IN ENERGY GENERATION DURING PG TEST AND PENALTY

S.No	Month	Average Global Horizontal Solar Insolation for the Month (As per Month wise Radiation and Generation Format of TDS) (kWh/m^2) (a)	Quoted Energy Generation for the Month (As quoted in Month wise Radiation and Generation Format of TDS) (kWh) (b)	No of Test days of the Month (c)	Pro rata Solar Insolation for the Month (kWh/m^2) (d) = (a) x (c)/ No of days in Month	Modified Energy Generation for the Month (kWh) (e)=(b) x (d) /(a)	Measured Average Global Horizontal Solar Insolation of the Month by the pyranometer (kWh/m^2) (f)	Base Generation for the Month (kWh) (g)= (e) x (f)/(d)	Measured Monthly Net Exported Energy (kWh) (h)	Shortfall for the Month (kWh) # (i) = (g)-(h)
1										
2										
3										
4										

Negative value denotes excess generation/ exported energy in comparison to base generation. No Incentive to contractor for excess energy generation/ export, however the same shall be considered while calculating the sum of column (i) for calculation the shortfall during PG Test.

Yearly shortfall in energy generation shall be calculated as given below:-

Yearly Shortfall= (Annual Quoted Minimum Guaranteed Generation x Shortfall in Energy Generation during PG Test Period (Sum of Column (i)) / (Base Generation for the Month (Sum of Column (g))

Compensation for Shortfall in Generation = Yearly Shortfall x Per unit compensation rate (Rs./kWh) for Generation Shortfall during PG Test mentioned in GCC/ elsewhere in bid document

Bidder's Seal and Signature of Authorised Representative

Annexure-III

COMPUTATION OF SHORT FALL IN ENERGY GENERATION DURING O&M PERIOD

O&M activity Month wise	Average Global Horizontal Solar Insolation for the month (As per Monthwise Radiation and Generation Format of TDS) (kWh/m^2) (a)	Quoted Energy Generation for the month (As quoted in Monthwise Radiation and Generation Format of TDS) (kWh) (b)	Modified Energy Generation Targets in corresponding month of a year of O&M period (kWh) (c) = (b) x MCF x PGF	Measured Average Global Horizontal Solar Insolation for the Month by Pyranometer (kWh/m^2) (d)	Measured Monthly Net Exported Energy (kWh) (e)	Base Generation for the Month (kWh) (f) = (d) x (c) / (a)	Shortfall of the month (Difference of Net Exported Energy and Base Generation for the Month (+) or (-) (kWh)) * (g) = (f) - (e)
Month 1							
Month 2							
Month 3							
Month 4							
Month 5							
Month 6							
Month 7							
Month 8							
Month 9							
Month 10							
Month 11							
Month 12							
Annual							

*Negative value denotes excess generation/ exported energy. No Incentive to contractor for excess energy generation/ exported, however the same shall be considered while calculating the sum of column (g) for deriving the annual shortfall/ excess in energy.

Note:

Rate of Compensation for Shortfall in Energy Exported in comparison to Base Generation: At prevailing tariff (PPA tariff) in Rs. /kWh for the Project.

Bidder's Seal and Signature of Authorised Representative

2 SPV MODULE AND ACCESSORIES

2.1 Scope of Work

Scope of work under this section covers the provision of labour, tools, plants, materials and performance of work necessary for the design, manufacture, quality assurance, quality control, shop assembly, shop testing, delivery at site, site storage and preservation, installation, commissioning, performance and acceptance testing, training of employer's personnel, handing over to employer and guarantee for five years of SPV Module for Solar Photovoltaic (SPV) Power Plant and as per the specifications hereunder, complete with all auxiliaries, accessories, spare parts and warranting a trouble free safe operation of the installation.

The scope of work shall be a comprehensive functional system covering all supply and services including but not be limited to following:

2.1.1 SPV Module

The Solar PV module comprises of PV cell(s) connected in any combination to achieve the required module power output. PV cells directly produces DC power on receipt of solar irradiation. The PV cells in a crystalline silicon module shall be protected by encapsulation between front glass and back sheet/back glass. The glass shall be made of high transmissivity and front surface shall give high encapsulation gain.

i) Peak power rating of the individual module shall not be less than 540Wp (no negative tolerance).

ii) Spare parts in accordance to clause 2.8 "Spare Parts" of this section.

iii) Tools and instruments in accordance to clause 2.9 "Tools and Instruments" of this section

Any other item(s) not mentioned specifically but necessary for the satisfactory completion of scope of work defined above, as per accepted standard(s) / best international practices.

2.2 Specific Parameters and Layout Conditions

All materials used shall have a proven history of reliability and stable operation in external applications. Each and every SPV module shall be checked for conformity with relevant standard and no negative tolerance shall be accepted. Module should have excellent performance under low light conditions and good temperature coefficient for better output in high temperature condition. The selection of solar PV modules would be technology agnostic to suit the solar projects where humidity levels are high and moisture ingress is more. The modules with suitable quality back sheets or glass to glass packed modules shall be used. The modules used shall have proven design and demonstrated performance in harsh environmental condition.

2.3 Rating & Functional Characteristics

a. Modules shall be made up of mono or poly crystalline silicon cells. The module should be PID resistant.

b. Peak power rating of the individual module shall not be less than 540Wp (no negative tolerance). Each module with positive power tolerance

guarantee of 0W to +5W to avoid array mismatch losses (value of positive power tolerance of each module shall not be added/considered in total peak power rating of the individual module). Additionally, the Module wattage band/bin offered shall not be less than 5Wp. Modules only with same rating shall be connected to any single inverter.

c. The module efficiency shall be greater than or equal to 20.79 % at standard test condition (STC) and the cell should have minimum fill factor of 0.70.

d. It shall perform satisfactorily in relative humidity ≥85% with ambient temperature range between (-) 10°C and (+) 60^0C and shall withstand gust equal or more than 170 km/h on the surface of the panel and shall be able to withstand mechanical load as per IEC requirement.

e. System Voltage shall be designed for min 1000 V DC.

f. Rated Power Temperature Coefficient for modules shall be > (-) 0.40% per ^{0}C for better yield.

g. The solar cell shall have surface anti-reflective coating to help to absorb more light in all weather conditions. Module shall be designed for not less than 25 years.

h. The solar module shall have suitable encapsulation and sealing arrangement to protect the silicon cells from the adverse environment condition. 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 including module edges shall ensure complete moisture proofing for the entire life of the modules.

i. The front surface of the module shall consist of impact resistant, low iron, high energy yield anti reflective and superior transmittance (more than 90) tempered glass with minimum thickness of 3.2 mm.

j. The bidder may also adopt frameless double glass module but suitable retaining clips/clamps used for installing the modules shall not damage the glass surface in contact with the retaining clamp. The thickness of glass shall be minimum 2.5 mm for both front and back glass. In case bidder adopts framed double glass solar PV modules including bifacial, the thickness shall be min 2.0 mm for both front and back glass.

k. The interconnected cells shall be laminated in vacuum to withstand adverse environmental conditions. The EVA used for the modules should be of UV resistant in nature with gel content of more than 70%. The back sheet used in the crystalline silicon based modules shall be of 3 layered structures. The thickness of back sheet should be of minimum 300 microns with water vapour transmission rate less than 2.0g/m^2/day (38°C at 90% RH). The back sheet can be fluoro-polymer based or of any other well proven technology details of which shall be submitted and reviewed during detailed engineering and shall be subject to Employer's approval. The back sheet shall have globally benchmarked durability properties on Moisture barrier, Tensile Strength (Machine Direction & Transverse Direction), Elongation retention and UV stability and shall be able to withstand maximum system voltage.

l. The module frame is to be made of corrosion resistant materials, aluminium anodized finish. The anodizing thickness shall be 15 micron or

better. The frame shall be electrolytically compatible with the structure material used for mounting the modules. In case the offered module is frameless, suitable retaining clips/clamps used for installing the modules shall not damage the glass surface in contact with the retaining clamp

m. Protective devices against surges shall be provided to protect the PV modules.

n. It is to be ensured that the Modules installed on MMS Table, in two rows, or on Tracker, should be connected so as to minimize the shading effect. For Fixed Type MMS, the same is to be achieved by connecting the modules in the upper row of consecutive tables in series. Similarly, the modules in the lower row are to be connected in series and to be kept separate from the modules in the upper row.

o. The junction box at the back of the module shall be weather proof, dust proof, UV resistant, free of halogen, and self-extinguishing to avoid fire propagation designed for long life out door operation in harsh environment as per relevant standard specification. The cables coming out of the junction box shall be suitably sealed providing complete electric isolation. Protection class of junction box shall be IP 68 or better rated fitted at the back side which should be weather proof and designed to be used with standard wiring or conduit connection. The junction box used in the modules shall have protective minimum 03 bypass diodes to prevent hot spots in case of cell mismatch or shading.

p. Each module should have two suitably sized stranded UV resistant cables and terminated with DC plug-in connector directly. The positive (+) terminal has a male connector while the negative (-) terminal has a female connector. Any different design offered shall be reviewed during detailed engineering. The connectors used for interconnecting the modules and connectors used for connecting the strings and/or to the String combiner Box, i.e. field connectors shall be of same make for better compatibility (refer Connectors chapter elsewhere for detailed Specification of Field Connectors). For 1500 V modules, the connecting cable shall be as per the relevant standard.

q. The Contractor shall provide protection against atmospheric lightning discharge to the PV arrays as per industry standards.

r. The Contractor shall provide data sheet of the offered module along with the offer giving details of peak power, peak current, peak power voltage, short circuit current, open circuit voltage, fill factor etc. and the sample solar PV module electrical characteristics including current-voltage (I-V) performance curves and temperature coefficients of power, voltage and current.

s. RF Identification Tag

Each PV module used in any solar power project must use a RF identification tag. The RFID shall be either placed inside the laminate or behind name plate sticker or behind bar code label pasted on the back sheet of PV module and must be able to withstand harsh environmental conditions during module life time. The following information must be mentioned in the RFID on each Module

(i) Name of the Manufacturer - PV Module & Solar Cells
(ii) Month and Year of the Manufacture (Separately for Solar Cells and Module)

(iii) Country of Origin (Separately for Solar Cells and Module)
(iv) I-V curve for Module at Standard Test Condition (1000 W/m^2, AM1.5, 25^0 C)
(v) Wattage, Im, Vm and FF for the Module
(vi) Unique Serial No and Model No of the module
(vii) Date and Year of obtaining IEC PV Module Qualification Certificate
(viii) Name of the test lab issuing IEC Certificate
(ix) Other relevant information on traceability of Solar Cells and Module as per ISO 9001

Site owners would be required to maintain accessibility to the list of Module IDs along with the above parametric data for each module.

t. Name Plate

Each module shall also carry the following clear and indelible markings at the back of module. Type of labels and fixing of labels shall be such that they are not likely to peel off/fall off during the life of the panel.

(i) Name, Monogram or Symbol of Manufacturer;
(ii) Type or Model number & Serial number;
(iii) Polarity of terminals or leads (colour coding is permissible);
(iv) Short Circuit Current (Isc), Open Circuit Voltage (Voc)
(v) Maximum Power (Pmax) , Voltage (Vmp), Current (Imp)
(vi) Maximum System Voltage for which the module is suitable;
(vii) Relevant Standards, Certification lab name
(viii) Weight of the Module
(ix) Overall Dimension (W x L x D)
(x) Module Wp tolerance (If it is cumbersome to supply this marking, then this marking can be left out)
(xi) NHPC Logo on the top corner of each Module (Design shall be provided to successful bidder during detail engineering)
(xii) Warnings, if any
(xiii) Date & Place of Manufacture.

2.3.1 MODULE CLEANING SYSTEM

Bidder shall propose solar modules cleaning system made of cleaning with water through pipe network

Solar Module Washing Systems with Fresh Water:

GSECL will arrange and provide the necessary water supply for operations and maintenance of the Solar Power Plant. GSECL will provide water at a single source/offtake point through a meter for each plot (each plot is of 100 MW Capacity). Contractor shall collect the water supplied by GSECL in a ground level water tank and water from this tank shall be used by Contractor by making its own arrangements as required. As per existing proposal, GSECL has proposed to supply maximum 6 KL/MW/Cycle so as to complete three cleaning cycle every month.

Bidder shall provide permanent arrangement for module washing in the SPV Plant. This shall include installing storage tank, deep tube/bore wells (If required) with pump and motor, requisite storage arrangement and laying network of HDPE pipe conforming to IS 4984 and other relevant codes. The module washing shall be complete in all respect and the details shall conform to the relevant IS codes. The complete scheme shall be subject to approval of the owner including inputs points, design and drawings for the system.

Opening from the HDPE pipe with manual isolating valves should be provided at regular intervals. The opening pipes for fixing the movable/Hose pipes for spraying water on module shall be made of GI pipe. Bidder shall install flow meter at pump discharge/ main header for measurement of water consumption.

Design of solar PV module cleaning system shall be designed such that complete solar plant can be cleaned with fresh water at least twice in a month. Module cleaning system piping network shall be close looped pipe network configuration consists of Main pipe, sub-main and branches in the main plot. In array layout, if solar blocks is separated from main plot due to natural water body, nallah, roads, etc; Module cleaning system piping network may be design for dead end/tree pipe network configuration. Cut off valves shall be provided at suitable junction points so that the repair works may be conducted at a particular area without disturbing the whole area.

The water used for cleaning should be of appropriate quality fit for cleaning purpose as per the recommendations of module manufacturer.

Bidder shall provide the piping and the instrumentation diagram (P&ID) of water washing arrangement including the physical sequence of branches, reducers, valves, pressure gauge, cleaning points with location of pump(s) and water storage tanks and submit for approval during detailed engineering.

The HDPE pipe shall be suitably protected against any impact load. The HDPE pipes shall be covered higher diameter GI pipe/NP3 Hume pipe at roads crossing for protection against any heavy loads etc. at roads section. The same protection shall also be provided wherever higher loads are expected. The bidder may also propose some other protection system for HDPE pipes.

Maximum length of hose pipe shall be 50 meters from tapping point. The entire water washing system shall be tested for minimum 0.5 N/mm2 or double the maximum working pressure, whichever is greater. End of the branch pipes/tapping points to be bent horizontal/downward to avoid entry of foreign materials like, earth, sand leaf, gravels, etc.

Bidder to ensure interconnection between the sub-systems of module washing system through isolating valve, so as module cleaning may be continued in case of outage of any sub-system. The other requirements are mentioned in technical specification of Civil Works.

Robotic Cleaning System (Not applicable for this package)

The Module mounting structure/ table shall be designed and modelled considering connection details for robotic cleaning for travelling from one table to another. Crossing of overhead lines, cables through trays & pedestals, connecting approach road between the rows of MMS/Table in layouts shall be avoided for optimum use of robotic cleaning system.

Model of working shall be automatic cleaning, IP65 protection level, self-powered system with battery backup (without external supply), it should be compatibility & integrated with SCADA.

Bidder shall supply the complete dry (water less) robotic cleaning system at site as per approved Array/ Plant layout drawings, and supervision of installation & commissioning by supplier along with owner O&M team, all other activities related to robotic cleaning including storage, loading, unloading, transportation within site, its supply including start end docking

station, bridge material required complete in all aspect, nuts and bolts, fasteners, installation, coordination, commissioning and any other activity not specified herein but required for successful commissioning of robotic cleaning system is included in the scope of Bidder.

Bidder shall ensure that erection, installation, movement or fixing of Robotic cleaning system shall not void the warranty of the solar modules.

2.3.2 Warranty for Module

Module warranty is defined as "The manufactures should warrant the solar module(s) to be free from the defects and/or failures specified below for a period not less than ten years from the date of sale to the original customer. Defects and/or failures due to manufacturing defects and/or failures due to materials non conformity to specifications/or due to faulty manufacturing, poor workmanship and/or inspection process. If the solar module(s) fails to conform to this warranty, the manufacturer will repair or replace the solar module(s) at the owner's sole option".

2.3.3 Performance Warranty for Module

Each Solar PV module used in solar power plants/ systems must be warranted for their output peak watt capacity, which should not be less than 90% at the end of 10 years and 80% at the end of 25 year from the successful commissioning. The system along with all auxiliaries and accessories shall be capable of performing intended duties under specified conditions. The Contractor shall warrantee for the reliability and performance of the individual equipment as well as of the complete system.

2.4 Performance Warrantee of System

The system along with all auxiliaries and accessories shall be capable of performing intended duties under specified conditions. The Contractor shall guarantee the reliability and performance of the individual equipment as well as of the complete system.

2.5 Design and Construction

2.5.1 Standards

The system and equipment shall be designed, built, tested and installed to the latest revisions of the following applicable standards. In the event of other standards being applicable they will be compared for specific requirement and specifically approved during detailed engineering for the purpose:

S.No.	Standards	Description
1	IS 14286 (Part-1, Part-II, Part 1-Sec-1)	Design qualification and type approval Part-1: Test Requirement Part-2: - Test Procedures Part-1 & Sec-1: Special requirements for testing of crystalline silicon photovoltaic (PV) modules

S.No.	Standards	Description
2	IS 61730- Part-I	Photovoltaic Modules safety qualification- Part-I: Requirements for Construction
3	IS 61730- Part-II	Photovoltaic Modules safety qualification-Part-II: Requirements for Testing
4	IEC 61701	Salt Mist Corrosion Testing of Photovoltaic Modules
5	IEC 62804 –1 : 2015	Photovoltaic Modules - Test methods for the detection of Potential Induced Degradation - Part 1:Crystalline Silicon

2.6 Drawings, Documents and Design Calculations

2.6.1 Design Memorandum

The Contractor shall submit to employer a design memorandum prepared in accordance to clause 1.6 “Record and Documentation” of “Section 1- General Technical Requirements.”

2.6.2 Drawings and Documents

The Contractor shall submit all the drawings and documents in accordance with requirements stipulated in “Section 2 - Technical Documents” of “General Technical Specification (GTS)”.

2.6.3 Design Calculation

The Contractor shall submit the design calculation in accordance to Clause 2.4 of “General Technical Specification (GTS)” covering at least the following, for review / acceptance.

- Data/calculations in regard to the surface load capacity & quantity of modules
- Any other data/calculation as required necessary

2.7 Delivery, Installation and Commissioning

The Contractor shall follow the requirements of Delivery, Installation and commissioning elaborated in clause 1.7 “Delivery, Installation and commissioning” of “Section 1 - General Technical Requirements.”

2.8 Spare Parts

Specified/Mandatory spare parts shall be supplied in accordance to clause 1.8 “Spare Parts” of “Section 1 - General Technical Requirements”. Specified spare parts to be supplied under this section are as follows:

S.No.	Description	Quantity
1	SPV Module along with Solar PV connecting wire with connector as mentioned	0.1% of total quantity used
2	Latest Version PV Syst Software	01 No License (to be delivered within one month of signing of Contract Agreement)

2.9 Tools and Instruments

The Contractor shall supply all necessary tools and instruments etc. for installation, repair and maintenance in accordance to clause 1.9 "Tools and Instruments" of "Section 1 - General Technical Requirements". Tools and Instruments to be supplied under this section are as follows:

S.No.	Description	Quantity
1	RFID reader compatible to read the data from the RFID tag & download to computer. Also all associated software & cables etc.	1 set
2	IR Hand-held Temperature Scanner (Reputed make)	1 No

2.10 Quality Assurance and Testing

The Contractor shall follow the quality assurance and testing requirements as per approved "Quality assurance and Testing Specifications (QTS)".

2.10.1 Type Test

SPV modules must be tested and certified by any of the accredited certifying agencies according to above mentioned international standards at Clause No. 2.5.1 and the type test reports shall be submitted for owner's approval.

Note:

1. The Module Manufacturer, along with the Module datasheet, shall also provide the Details about the PV Cells used for the offered PV Modules. The information shall contain Cell Source, Type, and Electrical Parameters including efficiency, Size, Number of Bus bars and any other relevant information.

2. Bidder shall submit the Self-certified Electro- Luminescence (EL) Test reports of all the Crystalline Silicon based PV Modules being offered.

3. Third-party verified PAN files for any one module, if bidder is offering three wattage bins or less. In case the bidder is offering more than three

wattage bins, additional PAN files for each additional wattage bin need to be submitted.

4. In line with Office Memorandum No. 283/54/2018-Grid Solar: “Approved Models and Manufactures of Solar Photovoltaic Modules (Requirement for Compulsory Registration) Order, 2019”, dated 2nd January 2019, MNRE’s subsequent OM dated 10.03.2021 regarding implementation of said order, including latest OM/amendments/Clarifications etc with respect to the said order, the bidder shall source cells/modules complying with the relevant clause(s) mentioned in the order. For detailed information, bidder to refer Office Memorandum/clarifications issued by MNRE. The applicability of ALMM shall be as per latest amendments as and when issued by MNRE.
5. In the event of Module manufacturer not having the latest BIS Test Certificates, ALL NECESSARY APPROVALS shall be accorded by NHPC based on the OLDER VERSION of Type Test Certificates. Bidder has to ensure to submit the latest BIS Type Tests before the despatch of the FINAL LOT of PV Modules. However, NHPC has the right to take suitable actions in case the Module Manufacturer fails to submit the latest BIS Type Tests as mentioned above.

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3.0 MODULE MOUNTING STRUCTURES

3.1 Scope of Work

Scope of work under this section covers the provision of labour, tools, plants, materials and performance of work necessary for the design, manufacture, quality assurance, quality control, shop assembly, shop testing, delivery at site, site storage and preservation, installation, commissioning, performance and acceptance testing, training of Employer's personnel, handing over to Employer and guarantee for five years of Module Mounting Structures for Solar Photovoltaic (SPV) Power Plant and as per the specifications hereunder, complete with all auxiliaries, accessories, spare parts and warranting a trouble free safe operation of the installation.

The scope of work shall be a comprehensive functional system covering all supply and services including but not be limited to following:

3.1.1 Mounting Structures

The PV modules shall be mounted on metallic structures called Module Mounting Structures (MMS). The scope would include one lot of mounting structures having adequate strength and appropriate design, which can withstand the load of the modules and design wind pressure & transfer the mechanical loads to the ground.

The contractor/manufacturer shall specify installation details of the Solar PV modules, Construction Methodology for MMS and its foundation with appropriate drawings & diagrams etc.

3.2 SPECIFIC PARAMETERS AND LAYOUT CONDITIONS

3.2.1 Layout and General Arrangement

1. The structure shall support required number of Solar PV modules to absorb and transfer the mechanical loads to the ground properly. There shall be no requirement of welding or complex machinery at site for installation of module mounting structure to the foundation.
2. The proposed foundation system for MMS shall be as per geo technical investigation report.
3. Modules shall be mounted on non-corrosive support structures with Automatic Motor Powered Realtime East-West Tracking.
4. The minimum clearance between the lower edge of the modules and the developed ground level shall not be less than 400 mm.

3.2.2 Operating Conditions

The structure shall be designed to allow easy replacement of any modules and easy access to the O & M staff and P&P (personal & protection). The MMS shall be designed in such a way so as not to cast any shadow (during the major plant operating hours) on the active part of a module. All the cables shall be aesthetically tied to MMS. The contractor/manufacturer shall specify installation details of Solar PV modules and support structures with appropriate drawings & diagrams.

Every major component of the plant should be suitably named/ numbered for easy traceability, identification and maintenance.

3.3 RATING AND FUNCTIONAL CHARACTERISTICS

Modules shall be mounted on a non-corrosive support structures.

Mounting structures shall be designed to withstand the extreme weather conditions in the area. The site design wind speed factors k1, k2, k3 and k4 shall conform to IS 875 (Part-3): 2015 for the design of MMS.

Design Loads:

Dead Load:

The load obtained by summing up the weight of modules and self-weight of Structure including Purlins, rafter/beams, Bracings, struts, columns, necessary fittings, etc. to be added as Dead load.

In case, String Combiner Box (SCB) is mounted on the Module Mounting structures, bidder to take into consideration the load of SCB during the design of MMS. Further suitable supporting members for mounting the SCB on the MMS shall also be within the scope of the bidder

Wind Pressure Force:

The wind pressure (positive and negative) force normal to surface on the modules and wind pressure force on the structural members.

The basic wind speed of the site is taken as 170 km/hr (Min).

Design wind load co-efficient k1, k2, k3 and k4 shall conform to IS 875 (Part-3): 2015. The design wind pressure derived from the above parameters shall be considered as minimum pressure and shall be further calculated accounting the external and internal pressure coefficients applicable for different slopes or pressure coefficient as per a Wind Tunnel Studies for the design of MMS. However, design wind pressure to be considered for design, shall not be taken less than the minimum wind pressure “pd” as mentioned in the General Technical Requirement.

The concept of wind tunnel studies may be considered in the design philosophy for fixed and seasonal tilt as well as Tracker based module mounting structure.

If the Bidder is going for wind tunnel study for the design and complete analysis MMS, following has to be ensured.

i. It must be done from an institute of repute having suitable wind tunnel facility (IITs / SERC Chennai or equivalent level institute in India).

ii. If the study is done by any reputed international facility the study results must be vetted by the wind domain expert at any of the IITs / SERC like institutes in India

Bidder may also refer to the detailed provisions for Tracker system given in this Chapter

Materials Specification & Coating for Structural Steel Works:

A.Hot-rolled/Cold-formed Steel Sections:

Members	Reference code	Yield strength, min, MPa	Non Coastal*		Coastal Area	
			Coating, Reference code	BMT (mm)	Coating Reference code	BMT (mm)
Column/ Vertical Post	IS 2062 / IS 1079	250	90 Micron (IS 4759) (Min)	2.0	110 Micron (IS 4759) (Min)	3.0
Bracing/ Rafter/ Beam/ Purlin				2.0		
Steel Tubes in all sections	IS 1161	240		2.0		
Hollow Steel in all sections	IS 4923	240		2.0		
Coupler/ Plate/ Cleat Splice/ Sag Angle	IS 2062	250		2.0		2.0
		Yield strength, MPa	**Coating Class Designation**			
Rafter/ Beam/ Purlin (Pre-Galvanized steel sections)	ASTM A653M/ IS 1079	255-550	Z600 (ASTM A653M/ IS 277)	1.6	Not Recommended in Coastal Class	
Note	A. Minimum elongation % shall be as per relevant Standard and Code. B. Materials shall be fabricated in the shop. C. Minimum coating & BMT requirement mentioned above in the table. D. All structural calculations of cold formed steel section for checking the adequacy for strength and deflection criteria is to be done taking into consideration the maximum permissible negative tolerance over specified BMT i.e. the lower limit of BMT is to be considered. E. The tolerance on Base Metal thickness(BMT) of steel shall be as given in IS 1852.					

B. Hot-dip Aluminium- Zinc alloy metallic coated sheet steel strip and sheet sections:					
Members	**Reference code**	**Yield strength, MPa**	**Coating Class Designation**	**BMT (mm)**	**Coastal Area**
Rafter/ Beam	ASTM A792M/ IS 15961	250 – 550	AZM150 (ASTM A792M) / (IS 15961)	1.2	Not recommended in coastal areas
Purlin (Top Hat Section)	ASTM A792M/ IS 15961	250 – 550	AZM150 (ASTM A792M) / (IS 15961)	0.9	Not recommended in coastal areas
Note	A. Minimum elongation % shall be as per relevant Standard and Code. B. Materials shll be fabricated in the shop. C. Minimum coating & BMT requirement mentioned above in the table. D. All structural calculations of cold formed steel section for checking the adequacy for strength and deflection criteria is to be done taking into consideration the maximum permissible negative tolerance over specified BMT i.e. the lower limit of BMT is to be considered. E. The tolerance on Base Metal thickness(BMT) of steel sheets and coils shall be as given in IS/ISO 16163.				

* Project location is classified into Coastal area if land location is within 60km from the nearest coast line.

Painting of Steel Surfaces embedded in Concrete: For the portion of Steel surfaces completely embedded in Concrete as reinforcement for foundation systems, the surface shall be prepared by Manual Cleaning and provided with Primer Coat of Chlorinated Rubber based Zinc Phosphate Primer of Minimum 50 Micron Dry Film Thickness (DFT).

Bidder shall also use principles governing design that shall prevent or reduce the risks of corrosion as per IS 9172 and relevant IS codes.

Connections

Fasteners (nuts, bolts and washers) for the following connections shall be of following type:

S.No.	Connection	Grade
1	Solar PV module to purlin/ structure connection	SS304, A2-70
2	Other structural fixed connections.	HDG 5.6 & 8.8
3	Foundation Anchoring.	HDG 4.6

Note: Fastener shall conform to IS 1367

A. SS304 Fasteners (nuts, bolts, washers and U-bolts) shall be of corrosion resistant austenitic steel. SS 304 Fasteners shall have a good anti-seize finish with proper wax coating for better durability and firm resistance to all types of failure including seasonal removal and re-fixing of bolts.

B. All fasteners shall be provided according to the connection design requirement. All bolts shall be tightened with designed torque mechanically immediately after the erection of MMS to avoid any possible damage due to any incidental storm during the erection stage.

C. One set of fastener shall consist of one hexagonal head nut, one hexagon shape bolt, and two washers. The bots and nuts with inbuilt washers may also be provided.

3.4 Performance Guarantee

The system along with all auxiliaries and accessories shall be capable of performing intended duties under specified conditions. The Contractor shall guarantee the reliability and performance of the individual equipment as well as of the complete system.

3.5 Design and Construction

3.5.1 Standards

The system and equipment shall be designed, built, tested and installed to the latest revisions of the following applicable standards. In the event of other standards being applicable they will be compared for specific requirement and specifically approved during detailed engineering for the purpose:

S.No	Standards	Description
1	IS 800: 1984	Code of Practice for general construction of steel
2	IS 875:Part 1& 2	Code of Practice for Design Loads for Buildings and Structure.
	IS875: Part 3	Code of Practice for the Design Loads for Building and Structures – Wind Loads
3	IS1893: 2002	Criteria for earthquake resistant design of structures - General provisions and buildings
4	IS513: 1994	Cold-rolled low carbon steel sheets and strips
5	IS814: 1991	Covered electrodes for manual metal arc welding of carbon and carbon manganese steel
6	IS 3043 - 1987	Grounding of mounting structures
7	IS2062	Hot Rolled Medium and High Tensile Structural Steel
8	IS811	Cold Formed Light Gauge Structural Steel Sections

S.No	Standards	Description
9	IS1161	Steel Tubes for Structural Purpose
10	IS4923	Hollow Steel Sections for Steel Structural use
11	IS 4759	Hot Dip Zinc coating on Structural Steel and other allied products
12	IS4736	Hot Dip Zinc coating on mild steel tubes
13	IS 1868	Anodic coatings on aluminium and its alloys.
14	IS: 2629	Recommended practice for hot-dip galvanizing of iron and steel
15	IS: 15961	Hot dip aluminium-zinc alloy metallic coated steel strip and sheet (plain)
16	IS: 9172	Recommended design practice for corrosion prevention of steel structures

Design Parameters

(A) The Ground mounting structure system which constitute a photovoltaic array(s) shall be designed to withstand the extreme fair wind (positive pressure) and adverse wind (negative pressure) on design tilt angle of solar photovoltaic array(s).

(B) The design calculations shall be supplemented with neat sketch and reference to various clauses of Technical specification and Indian standards.

(C) MMS design & analysis to be done on computer software (preferably STAAD) and the Bidder shall submit a write-up on the computer program used and its input (soft format) and output data for review and approval. An increase in allowable stresses of structural materials should not be considered during design analysis.

(D) Wind pressure for following loads shall be considered as follows:

- Dead Load of steel with all members, fittings & panels.
- Load due to fair wind direction on design tilt angles of solar mounting structural members.
- Load due to adverse wind direction on design tilt angles of solar mounting structural members.
- Load on side face of mounting structural members.

(E) Wind pressure coefficient, load and load combination, load test/factor of safety shall be as per Indian standards (latest revision) such as IS: 875, IS: 800, IS: 801 etc.

(F) Design analysis and the forces on MMS (Compressive force, uplift force, shear and moment) shall be used for design of foundation system.

(G) Technical requirements/ parameter of the Tracker System shall be as per specification given in this chapter. The Tracker System shall be of proven design. Design shall be based in accordance with the site climatic conditions and seismic loads, soil characteristics, thermal

loads caused by expected fluctuations of materials and ambient temperatures and the minimum required design wind speed.

Vertical Deflection and Horizontal Sway Limits:

Limiting Deflection: The limiting permissible vertical deflection for structural steel members shall be as mentioned below :

Maximum vertical deflection in purlin = Span/180,

Maximum vertical deflection in rafter (cantilever span) = Span/180 and

Maximum lateral deflection in column / verticalpost = Height/240.

All deflection limits can also be as per the serviceability limit defined by the module manufacturer & tracker manufacturer OR the proposed deflection limits duly approved by the module manufacturer during detailed engineering.

3.5.1 Foundation System

Top of concrete/ height of collar for MMS foundation shall be minimum 150 mm above Finished Ground Level (FGL).

The proposed foundation system for MMS shall be based on findings/ results of the approved geo technical investigation. Following kind of foundation may be provided:

1. Short pile foundation (Min. 300mm dia.)
2. Rock anchor with concrete collar (Min 700 Sq cm)
3. Isolated, strip or raft foundation
4. Concrete ballast foundation

TRACKING SYSTEM

General

The PV modules shall be mounted on metallic structures called Module Mounting Structures (MMS) having adequate strength and appropriate design, which can withstand the load of the modules and design wind pressure. Modules shall be mounted on non-corrosive support structures with Automatic motor powered Realtime East-West tracking.

Tracker System: -

The Tracker System shall be of proven design capable of tracking Sun's path actively, intended to maximize the energy output from PV Module. Design shall be based in accordance with the site climatic conditions and seismic loads, soil characteristics, thermal loads caused by expected fluctuations of materials and ambient temperatures and the minimum required design wind speed.

CODES AND STANDARDS

The applicable codes and standards are as mentioned below.

1	UL 2703	Standard for Mounting Systems, Mounting Devices, Clamping/Retention Devices, and Ground Lugs for Use with Flat-Plate Photovoltaic Modules and Panels or equivalent
2	UL 3703	Standard for Solar Trackers or equivalent
3	IEC TS 62727	Photovoltaic systems - Specification for solar trackers
4	IEC 62817:2014+AMD1:2017 CSV:	Photovoltaic systems – Design qualification of solar tracker
5	IS 875: Part 1 & 2	Code of practice for the design loads for buildings and structures
6	IS 875: Part 3	Code of practice for the design loads for buildings and structures-Wind Loads
7	IS 800: 2007	Code of practice for use of structural steel in general building construction
8	IS 4759	Hot-dip zinc coatings on structural steel and other allied products
9	IS 1868	Anodic Coatings on Aluminium and its Alloys

Equivalent National and International standard/code would also be acceptable Module Mounting structures (MMS) with trackers

DESIGN

a) Only single axis East-West real time tracking

b) Configuration - Both, single and multi-rows options are accepted.

c) Tracker Range of Movement (ROM): +/- 45 degrees or better

d) DC Self-powered drive system with battery backup of 3 days autonomy.

e) Individual row-level bi-directional control

f) Redundant communication (wireless) for individual Trackers

g) Stow configuration: optimal Angle, as per aero elastic instability analysis.

h) Design wind speed as per site condition, basic wind speed as per wind map of India from IS 875 Part 3: 2015.

i) Suitable material for corrosion category compliance as per Corrosion map of India, EN ISO 14713, EN ISO 1461, EN ISO 12944-5 or ASTM 123.

j) Operational temp: -10 to 50 degree Celsius.

k) Integration to Plant SCADA

l) Cleaning - Compliant with robotic module cleaning

Array layout shall be designed considering future provision for operating Robotic cleaning system from reputed manufacturers/suppliers. The continuous length of solar array table (or MMS) for using Robotic cleaning system, the distance between two modules of two different Array tables, required levelling and grading shall be done by the bidder. The bidder shall provide the details of compatible models of Robotic cleaning system from a different manufacturers/supplier and same shall be used in detail engineering of array layout design. Supply of Robotic Cleaning system is not in the bidder scope.

REQUIREMENTS

a) Tracking system shall be followed by either means of sun's positioning algorithm or optimization algorithm with a minimum tracking accuracy of ± 2° between the pointing vector of the sun and the pointing vector of the modules.

b) The tracking system shall have back tracking algorithm to avoid inter-row shading and optimizing irradiance collection for both row avoidance shading and diffuse light optimization.

c) All local tracking controls shall be mounted on the tracking structure. A suitable arrangement/bellows shall be provisioned to protect actuator assembly from extreme outdoor harsh condition, dust and UV rays.

d) In case of failure of supply, the arrays should return to the stow position. Bidder shall supply a tracking mechanism with an inbuilt feature for meeting the requirement.

e) All modules associated with a specific tracking system should be connected to a common inverter.

f) Suitable redundancy in sensing and auxiliary power supply shall be provided for fail-safe stowing of trackers. Redundancy in control is also desirable for the safe operation of trackers. Detail of the scheme for various redundancy shall be finalized at the time of detailed engineering.

g) Safety measures such as stop devices shall be applied to ensure personal safety.

h) Tracker shall be equipped with safety features like, auto high wind stow to the designed angular position and shall have uninterrupted communication with monitoring console/station. It should be capable of sending alarms to the monitoring station in case of failure or abnormal operations of the tracking systems.

i) For each row an earthing cable shall be installed to interconnect all metallic parts of foundation, tracker structure and PV modules of each table.

j) Tracker design shall also include a provision for fastening DC cables to the structure each 500mm without causing tearing or fluttering of cables.

k) Tracker shall able to track as per proposed stow strategy supported by Wind Tunnel test.

l) Tracker Torque Tubes should be galvanized in accordance with, ISO 1461, ISO 14713, ISO 9223, or relevant standard as per Corrosive Category of proposed Solar PV Site.

m) Minimum 400mm clearance to be maintain at module edge with maximum angle.

MODULE MOUNTING ARRANGEMENT

a) Module mounting structures shall be designed to withstand the extreme weather conditions in the area. The site design wind speed factors k1, k2, k3 and k4 and pressure coefficient shall conform to IS 875 (Part-3): 2015 or as per a Wind Tunnel Study from a reputed national/international facility, for the design of MMS. However, design wind pressure to be considered for design, shall not be taken less than the minimum wind pressure "pd" as mentioned in the General Technical Requirement.

   If the Bidder is going for wind tunnel test for the design and analysis of complete MMS and solar tracking system following shall be ensured.

   (i) It must be done from an institute of repute (IITs / SERC or equivalent) in India)/ international facility.

   (ii) Bidders must ensure that offered tracker has proven design with wind tunnel test simulating actual site conditions. The analysis and design shall be completed within two months from the actual date of issue of LOA.

   (iii) Test results and design must comply with relevant Indian/ International codes.

   (iv) The design shall be shown in STAAD pro or similar commercially available software for further checking of NHPC as and when required.

   (v) Refer General Technical Requirement & Technical Data Sheet for site-specific design parameters

b) The structural material and design shall be as per Design Criteria for Module Mounting Structures (MMS). The structural Material Yield Strength and Minimum Design Thickness can be as per "Proprietary Design" of Tracker supplier, and It shall conform to Indian / international codal design provisions. The Proposed Solar PV tracker system same should be certified for successful performance of MMS and tracker system by designer for its design life of 25 Years after date of successful commissioning.

c) The design and the calculations for the MMS and the foundation system shall be submitted for prior approval of NHPC before the commencement of construction and shall be based on the soil Geotechnical Investigation report.

d) Further details related to structures and foundations have been mentioned in the chapter on civil works of these specifications.

e) The Structure shall be designed and analyzed in accordance with finite element method, the fundamental principles of Engineering using commercially available software (such as STAAD pro or similar), with dead load and wind load considered as per IS: 875 (Part 1& 3,

respectively) or as per Wind Tunnel study done from a reputed national/international facility. Analysis shall be done as per appropriate load combinations preferably as per IS codes.

f) The Structure must be provided with limit switches to control the rotation of the frame.

g) All nuts & bolts or clamps shall be of Stainless steel, Aluminium or Metal Alloy type for a module to structure connection, and other structural bolts shall be of grade HDG 5.6 or 8.8 or exclusively designed for solar tracker systems by manufacturers, which should suffice the design life for 25 years and more.

h) Tracker Based MMS would be provided with Module Supporting Member(s) including the provision for fixing of modules, such that the maximum stress in module frame is limited to +/-2400Pa under Wind Load or any Combination.

PROTECTION AGAINST CORROSION & UV

Appropriate measures shall be considered, as required, to protect the structure, foundation, and all components against corrosion during the expected lifetime of the Plant. Structural steel shall be hot dip galvanized as per ISO 1461 (or BS 729), EN 10346, ISO 14713, IS 4759, ISO 9223 and as per Corrosive Category of proposed Solar PV Site.

Non-metallic materials placed outdoors shall be UV and sand resistant and withstand high ambient temperature operation regimes as per the climatic conditions over the whole Plant design lifetime, and where materials are specified in any part of this bid document, those characteristics are to be considered as a minimum requirement. Metallic materials are not explicitly required to be UV resistant but in case protective coating is required, this shall be UV and sand resistant. All materials used for concrete, reinforced concrete structures, steel structures, aluminum structures or structural elements or any other building material shall be of high quality, free from defects likely to undermine the strength and duration of service of the Plant.

BEARING

a) The bearing should be type tested for operation cycles which solar plant will go through in its life of 25 years.

b) Preferably there should not be any lubrication in the bearing, but if there is any, then it should be maintenance free. No cleaning should be needed.

c) The bearing should also be resistant to dust, water and any other external parameters.

MOTOR AND ACTUATOR

a) The motor should be IP 65 or better and it should be powered by reliable supply to drive the link through gear or hydraulic/electric actuator.

b) The temperature rises in the motor during operation specified in IS12802: 1989 should not be more than approximately 10°C.

c) The location and moisture or fumes shall not seriously interfere with the operation of the motor.

d) The severity of vibration for the motors shall be within the limits specified in IS 12075: 1987.

CONTROLLERS

a) Trackers should have an industrial grade system for its automatic control and operations. For all outdoor controllers, it should be housed in IP-65 enclosure.

b) Battery back-up should be provided for Controller and motor for at least 15 minutes with power pack cum UPS. Alternatively, the bidder can provide backup power from the UPS of inverter room or Main Control room.

c) The controller must be enabled with a feature of stowing during high-speed winds.

d) The Real Time Clock (RTC) of the trackers shall have a facility to be time synchronized with SCADA on Network Time Protocol (NTP).

e) A suitable communication link between the controller and tracker SCADA system shall be arranged. The software for communication and analysis shall be provided by the tracker supplier. Tracker SCADA shall be interfaced with solar SCADA on an open protocol such as MODBUS.

f) Battery back-up should be provided for Controller and motor as per design specified above under heading Design. Alternatively, the bidder can provide backup power from the UPS of inverter room or Main Control room.

STUDIES/REPORTS

The following studies, and reports shall be submitted by the Bidder for the offered solution. The studies and reports shall provide a positive outcome of the respective tests, designs, and concepts for the utilization of the proposed single axis tracking system in the Project:

Stow strategy control system: The Tracker supplier is solely responsible for the definition and implementation of a proper stow strategy, which clearly demonstrates and guarantees the safe operation of the tracker during all wind events with speed up to and including the maximum one defined as per local structural code. The following points, including but not limited to, should be made available as part of the safety stow strategy:

- Tracker inclination and orientation at safety stow position
- Maximum wind speed in [m/s] as [3-sec gust / 10min average] defined at 10m height which the tracker can withstand in working position
- Stow alarm function and wind speed at which it is triggered
- Safety strategy during installation / commissioning
- In case that batteries are used, which is the minimum charge level required in order to reach safety stow position
- Security of communication protocols required for the active stow
- Time requirement to move the tracker from working position into stow position considering also safety factors
- System redundancies that help to minimize risk of failure. Emergency system in case of tracking or measurement defects

- Dynamic analysis and tests along with static coefficients based on the actual tracker configuration, stiffnesses and geometry
- Aeroelastic instability analysis for the proposed tracker structure to show that the stow angle will not result in aeroelastic instability
- Definition of tolerances, maximum terrain inclinations North-South, East-West

g) Wind tunnel tests from a recognized wind expert institute (CPP Wind Engineering, RWDI or an alternative experienced institute subject to approval by the Off taker).

h) Independent Engineers Bankability review report from reputable agencies like Black and Veatch, DNV, IITs or other premier institutions/agencies.

i) Structure design review document from any IIT civil/Structural certifying department, if required

WARRANTY

25-year lifetime design (at least) considering local ambient conditions and in respect of all standards for the PV modules support structures and foundations

5-year warranty starting with the commissioning with full capacity of Project for the complete mounting structure including but not limited to the design, material, and installation of the tracker, substructure, power unit, piles, and foundations

25 years for corrosion protection.

3.6 Drawings, Documents and Design Calculations

Design memorandum

The Contractor shall submit to Employer a design memorandum prepared in accordance to clause 1.6 “Record and Documentation” of “Section 1-General Technical Requirements.”

Drawings and documents

The Contractor shall submit all the drawings and documents in accordance with requirements stipulated in “Section 2 - Technical Documents” of “General Technical Specification (GTS)”.

Design calculation

The Contractor shall submit the design calculation in accordance to Clause 2.4 of “General Technical Specification (GTS)” covering at least the following, for review / acceptance.

- Data/calculations in regard to the loads
- Design philosophy and calculation for design of steel structure and load on foundation

Design should be proof checked by employer and have to be got approved from employer before actual start of work.

3.7 Delivery, Installation and Commissioning

The Contractor shall follow the requirements of Delivery, Installation and commissioning elaborated in clause 1.7 “Delivery, Installation and commissioning” of “Section 1 - General Technical Requirements.”

3.8 Spare Parts

Specified/Mandatory spare parts shall be supplied in accordance to clause 1.8 “Spare Parts” of “Section 1 - General Technical Requirements”. Specified spare parts to be supplied under this section are as follows:

S.No.	Description	Quantity
1	Tracker motor	0.25% of total used of each type
2	Battery pack (if applicable)	0.25% of total used of each type
3	Control box (with all components including cards)	0.25% of total used of each type
4	Bearings (if applicable)	0.25% of total used of each type
5	All type of sensors	0.25% of total used of each type
6	Driving mechanism	0.25% of total used of each type

3.9 Quality Assurance and Testing

The Contractor shall follow the quality assurance and testing requirements as per approved “Quality assurance and Testing Specifications (QTS)”.

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4 POWER CONDITIONING UNIT

4.1 SCOPE OF WORK

Scope of work under this section covers the provision of labour, tools, plants, materials and performance of work necessary for the design, manufacture, quality assurance, quality control, shop assembly, shop testing, delivery at site, site storage and preservation, installation, commissioning, performance and acceptance testing, training of employer's personnel, handing over to employer and warrantee for five years of Power conditioning Units for Solar Photovoltaic (SPV) Power Plant and as per the specifications hereunder, complete with all auxiliaries, accessories, spare parts and warranting a trouble free safe operation of the installation.

The scope of work shall be a comprehensive functional system covering all supply and services including but not be limited to following:

4.1.1 Power Conditioning Unit

i) The Power Conditioning Unit (PCU) / String Inverter are Solar Inverter designed to convert solar PV DC power to 3-phase AC power and fed into utility grid. Power Conditioning Unit (PCU) consists of an electronic inverter along with associated control, protection, filtering, measuring instruments and data logging devices. The PCU/ String Inverter shall have maximum power point tracker (MPPT) for operating the inverter at its maximum power point. The PCU/ String Inverter shall be designed to supply three phase AC power to the grid at load without any disturbance. The PCU/ String Inverter shall automatically adjust the voltage & frequency levels to suit the Grid condition. All three phases shall be supervised with respect to rise/fall in programmable threshold values of frequency. The model offered should be in operational condition in India.

ii) Spare parts in accordance to clause 4.8 "Spare Parts" of this section.

Any other item(s) not mentioned specifically but necessary for the satisfactory completion of scope of work defined above, as per accepted standard(s) / best international practices.

4.2 SPECIFIC PARAMETERS AND LAYOUT CONDITIONS

4.2.1 Layout and General Arrangement

PCU shall be placed indoor (in Pre Engineered Board (PEB) room) /outdoor/ in container, based on optimization of available area utilization with appropriate array layout for maximum power packaging.

Containerized/outdoor central Inverter (PCU) and string inverters shall also be acceptable. In case of string inverter, associated switchgear shall either be outdoor type with enclosure or Indoor type placed in pre-engineered rooms.

CENTRAL INVERTER

1. Suitable rated fuse shall be provided (at inverter end) in incoming DC cable from each string combiner box (SCB). One set spare terminal with fuse (as applicable) and holder shall be provided for the future use. In addition, the PCU shall have suitable rated DC motorized isolator/MCCB or contactor for isolation of PV array from inverter.

2. Inverters shall be of 3-phase, 50 Hz. PCU must have provision to be isolated from grid through Air Circuit Breakers/MCCB's. The ACBs/MCCBs as required can be provided as shall be a part of PCU/its Modules or separately based on standard design and configuration of PCU manufacturer. The ACB and MCCB shall be able to withstand the maximum fault current for minimum one sec duration. ACB/MCCB shall be able to isolate PCU from AC grid under all fault current condition.

3. 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 shall be able to provide the measured DC current value and calculated DC power and energy value of incoming SCB DC cable to SCADA system for remote monitoring, storing and report generation. In case PCU does not have the facility/capability for power and energy calculation within its controller, then Bidder can provide the same facility in SCADA system.

4. 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 systems 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.

5. Local Display unit for viewing important parameters, configuration and troubleshooting purpose shall be provided as per inverter manufacture practice. In case standard design of inverter does not include display, then inverter shall be provided with required software along with accessories (5 sets) for interface for mobile viewing and configuration with laptop. One no of dedicated laptop of suitable configuration with five years onsite warranty including battery backup, software and other accessories shall be provided.

6. PCU shall have suitable communication card (Modbus/Ethernet) for networking and SCADA integration and same shall support dual master communication. Communication port shall be preferably TCP/IP protocol. 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.

7. Bidder may offer liquid cooling system subject to Employer 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.

8. 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 is more than safe operating limit.

9. Inverter shall offer provision for both local and remote emergency stop push button for tripping of inverter with complete AC electric isolation.

INDOOR CENTRAL INVERTER

a) The PCU enclosure protection class shall be IP 20 or better protection.

b) COOLING AND VENTILATION:- 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. Filter banks at the air inlet of the inverter room shall be provided to prevent dust ingress. Bidder shall furnish peak power consumption of cooling system (cooling fans, pumps etc.) of the PCU along with the data sheet. Ventilation shall be designed in such a way that the temperature rise of the inverter rooms does not 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.

c) Bidder has to provide higher of 450 mm clearance or manufacturer's recommendation for clearance from the nearest wall. If the inverters are housed in pre-engineered rooms in more than two rows (back to back arrangement), at least 500 mm corridor shall be provided in between the rows. In case, Inverters are placed in two rows (with doors facing each other) min. 2m corridor shall be provided for ease of maintenance.

OUTDOOR CENTRAL INVERTER INCLUDING CONTAINERISED SOLUTION

a) Outdoor PCU (including containerized solution) with metallic enclosure are acceptable. The enclosure must be suitable to withstand the harsh environmental conditions for complete life of plant.

b) The PCU enclosure protection class shall be IP 54 or better protection. For outdoor solution (other than containerised) electronics card compartment shall have IP 65 or better protection.

c) Bidder to submit temperature endurance test report of complete assembly during detail engineering stage.

d) For Outdoor PCU (without containerised solution), the complete assembly should be placed inside a shed made of structural steel section preferably tubular/hollow section and colour coated metal

sheets for roof with BMT 0.5 mm and at least 60cm projection in all side. For containerized solution separate shed is not required, however, the container shall have projection of at least 60cm wherever an opening in the inverter door exposes the inverter component to outside environment. Structural steel and paints for shed shall be as per ISO 12944-5.

e) Outdoor inverter (including containerized solution) platform shall be raised Min 1250 mm from NGL. Cable bending radius and other relevant factors to be considered during platform design. This shall be reviewed during detailed engineering.

STRING INVERTER

a) All electrical design, operational and functional parameters/ characteristics shall be identical to the philosophy of the central inverters (PCU).

b) The string inverter, if installed on ground should be placed inside a canopy shed with at least 15 cm in all direction. Alternatively, the Bidder can also install the inverter on the column post of the module mounting structure (if applicable), below the modules. In such case, the canopy is not required and the column and foundation shall be designed accordingly.

c) String inverter shall have suitable communication port (RS485/TCP-IP/PLC) for SCADA integration. All necessary hardware, software and accessories used for communication with SCADA (including smart Data logger) at both the ends shall be provided by the bidder. String Inverters system shall support dual master communication.

d) String inverter shall have monitoring capability (MPPT Level) and reporting to SCADA system. Any special software if required for this purposes shall be provided for local and remote monitoring and report.

e) The string inverter protection class shall be IP 65 or better protection.

f) Anti-PID device along with all hardware and communication cable/device shall be provided in case provision of negative earthing of PV string is not available in string inverter. Data logger used in Anti-PID device shall be integrated with SCADA system.

g) String inverter shall have LVRT and other feature as per CEA grid regulation code. Auxiliary power supply system of string inverter shall be suitably designed so that string inverter shall be able to meet the LVRT Requirement.

h) DC fuse requirement for PV string at string inverter end shall be as per string manufacture/system requirement and same shall be finalized during detail engineering.

i) Provision for AC and DC electrical isolation device (such as MCB/MCCB/Isolator) inside string shall be as per string inverter manufacturer practice.

j) Local Display unit for viewing important parameters, configuration and troubleshooting purpose shall be provided as per string inverter

manufacture practice. In case standard design of string inverter does not include display, then string inverter shall be provided with required software along with accessories (5 sets) for interface with inverter or facility for mobile viewing and configuration with laptop. One no of dedicated laptop of suitable configuration with five years onsite warranty including battery backup, software and other accessories shall be provided.

AC Junction Box for String Inverter

a) Separate AC Junction box shall be used for string inverters. Protection class for AC junction box shall be IP 54 or better protection. All components of junction box shall be suitable for rated output voltage (with + 10% variation) of string inverter, grid frequency of 50 Hz +/-5%, ambient temperature 50 deg. C and system fault current for 1 sec.

b) AC junction box shall be of metal enclosed type. All frames and load bearing members shall be fabricated using suitable mild steel structural sections or pressed and shaped cold-rolled sheet steel of thickness 2.0 mm. Frames shall be enclosed in cold-rolled sheet steel of thickness 1.6 mm. Doors and covers shall also be of cold rolled sheet steel of thickness 1.6 mm. Stiffeners shall be provided wherever necessary. The gland plate thickness shall be 3.0 mm for hot / cold-rolled sheet steel and 4.0 mm for non-magnetic material. The minimum clearance in air between phases and between phases and earth shall be at least twenty five (25) mm throughout. Wherever it is not possible to maintain these clearances, insulation shall be provided by sleeving or barriers.

c) All power cable terminals shall be of stud type and the power cable lugs shall be of tinned copper solder less crimping ring type conforming to IS: 8309. All lugs shall be insulated/ sleeved.

d) EPDM / Neoprene gasket shall be used to prevent ingress of dust into panels.

e) All non-current carrying metal work of the junction box shall be effectively connected to the system earth bus.

f) Finishing paint shade for complete panels excluding end covers shall be RAL9002 & RAL5012 for extreme end covers of all boards, unless required otherwise by the Employer. The paint thickness shall not be less than 50 microns.

g) Other requirement related to switchboards, switchgear etc shall be as per the specifications mentioned in chapter of 415 V/ LT Switchgear.

4.2.2 Operating Condition

The inverter shall be capable of operation between 0^0C to +60^0C ambient temperature.

4.3 FUNCTIONAL CHARACTERISTICS

4.3.1 Rating

The continuous combined MW rating of all PCUs / inverters at 0.95 power factor and at 0.95 p.u. voltage at Inverter terminal at ambient temperature of 50 deg C/ as calculated from methodology shall not be less than Plant MW capacity.

For locations where ambient temperature works out to be more than 50 degrees as per the methodology given in report namely "Data Submission Procedure and Verification of Compliance to CEA Regulations on Technical Standards for Connectivity to the Grid by RE Generators", the above cumulative rating shall not be less than the plant capacity at that calculated temperature.

The actual cumulative capacity of inverter to be installed in the plant shall be decided during detailed engineering after taking into consideration the compliances to be made by RE Generator in relation to CEA Regulations on Technical Standards for Connectivity to the Grid. The report namely "Data Submission Procedure and Verification of Compliance to CEA Regulations on Technical Standards for Connectivity to the Grid by RE Generators" may also be referred to for this purpose.

Bidder shall also furnish maximum overloading capacity of the inverter with respect to temperature along with inverter data sheet.

4.3.2 General Requirement

i. The PCU/ String inverter shall have anti - islanding protection in the event of outage of grid/ voltage & frequency beyond acceptable limits and should reconnect the grid automatically after restoration of grid. Anti-islanding protection should be activated only if, voltage profile is outside LVRT curve.

ii. The PCU/ String inverter shall comply Electromagnetic compatibility (EMC) as per applicable standards.

iii. The PCU/ String inverter shall be designed & built to meet safety requirements as per applicable standards.

iv. The PCU/ String inverter shall include appropriate self protective and self diagnostic feature to protect itself and the PV array from damage in the event of PCU/ String inverter component failure or from parameters beyond the inverter safe operating range due to internal or external causes. The self-protective features shall not allow signals from the inverter front panel to cause the inverter to be operated in a manner which may be unsafe or damaging. Faults due to malfunctioning within the PCU/ String inverter, including commutation failure, shall be cleared by the PCU/ String inverter protective devices.

v. The contractor shall ensure by carrying out all necessary studies that the PCU/ String inverter will not excite any resonant condition in the system that may result in the islanded operation of PV plant and loss of generation. Inverter can start giving high efficiency at low power itself. 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.

vi. In case external auxiliary power supply is required, UPS shall be used to meet auxiliary/control power requirement of PCU and String inverter as per the details mentioned in the Chapter of DC System. he batteries used for these UPS shall be VRLA Type.

vii. In case auxiliary supply of PCU/ String inverter is met internally, then it should have sufficient power backup to meet the LVRT requirement. Bidder needs to submit the detail auxiliary supply arrangement for PCU/ String inverter during detail engineering stage.

viii. PCU/ String inverter 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). Inverter 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.

ix. PCU/ String inverter shall offer the possibility to set a constant reactive power mode to absorb or inject reactive power during night time. The night time reactive power compensation capability of the inverters must be adequate to take care of the plant reactive power requirements for cables, transformers, etc. at night.

x. The PCU shall be capable of supplying reactive power as per grid requirement during solar and non-solar hours. PCU shall have Static VAR Generation (SVG) function (Q at night)PCU/ String inverter shall have in built necessary limiters in the control so as to ensure its safe operation within the designed operational parameters.

xi. The monitoring/measurement of DC inputs (central inverter) and AC output shall be done using transducers/instruments having sensor accuracy of 1.0 class or better.

xii. 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.

xiii. 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 in action and trip operated, HVRT trip, islanding protection operated, over current operated, Inverter cabinet temperature high alarm and all other important signals. Details shall be finalized during details engineering stage.

xiv. One number of laptop PC shall be supplied for PCU/ String inverterconfiguration and troubleshooting purpose. Laptop shall be supplied with complete set of hardware & software accessories. Laptop detailed configuration must ensure suitability for the required applications. Supplied Laptop shall be protected with the latest anti-virus software and shall be provided 5 Years onsite warranty including its battery. At least two sets of communication cable for Laptop to PCU/ String inverter communication shall be provided.

xv. PCU/ String inverter shall be provided with Mobile user interface facility (Min 5 Nos) for monitoring status of inverters. The system

should give message alert in case any inverter is tripped due to any fault. An inverter event list is stored with important messages highlighted to enable the user to keep track of inverter status at all times for better O&M and highest yield from the PV plant. In case PCU/ String inverter does not have this facility, then Bidder can provide the same facility through plant SCADA system. All required hardware and software including Mobile App required for this purpose shall be provided by Bidder.

xvi. Bidder to submit third-party verified OND files of the inverter during detail engineering.

4.3.3 Efficiency

The inverter efficiency shall be tested & shall be 98.0% or higher at 75% load as per IEC 61683 or equivalent standard. The Contractor shall specify the conversion efficiency at different load say 25%, 50%, 75% and 100% during detail engineering, which shall be confirmed by type test reports.

4.3.4 Grid Interaction

i. The PCU/ String Inverter shall remain connected to the grid per CEA Technical (standards for connectivity to the grid) regulation 2007 with all latest amendments (including 2019) and its components shall be designed accordingly.
ii. In case of grid failure, the PCU/ String Inverter shall have re-synchronized with grid after revival of power supply. The inverter shall have provision for galvanic isolation.Bidder to furnish the time taken by PCU/ String inverter to be re-synchronized after restoration of grid supply during detailed engineering.
iii. The PCU/ String inverter shall be able to deliver rated output in the frequency range of 49.5 Hz to 50.5 Hz. This performance shall be achieved with voltage variation of up to ± 5% subject to availability of solar insolation.
iv. Inverter shall be equipped with Voltage Ride-Through (VRT) capabilities to stay online during grid disturbance as per CEA technical standard for grid connectivity.
v. PV system characteristics of utility interface shall be as per IEC 61727.
vi. Each solid state electronic device shall have to be protected to ensure long life as well as smooth functioning of the inverter.
vii. The PCU/ String inverter shall also be compatible to work combination of inverters through a multi winding transformer.

4.3.5 Protections

The PCU/ String inverter shall have required protection arrangements against reverse polarity of DC connection and remains in standby mode.

PCU/ String inverter shall have arrangement for adjusting DC input current and should trip against sustainable fault downstream and shall not start till the fault is rectified.

Protection shall include negative sequence protection as such that if the balancing of 3 phase system failed, the protection shall envisage isolation of the inverter from the circuit.

The PCU/ String inverter shall have its suitable protection arrangement against any sustained fault in the internal & external associated circuit. The inverter should have proper protection against lightning.

PCU/ String inverter shall have the adequate protection against earth leakage faults. Inverters shall also be capable of reporting ground faults to the power plant monitoring and control system. Inverters shall be equipped with line to line and line to ground overvoltage protection schemes included on the DC input bus, AC output terminals and all external control, communication and auxiliary power terminations.

PCU/ String inverter shall be equipped with surge protection on the DC input bus, AC output terminals and all external control, communication and auxiliary power terminations.

Internal surge protection device shall be provided in the PCU/ String inverter on DC and AC side. It shall consist of Metal Oxide Varistors (MOV) type surge arrestors. The discharge capability of the SPD shall be at least 12.5kA at 8/20 micro second wave as per IEC 61643-12. During Earth fault and failure of MOV, the SPD shall safely disconnect the healthy system. SPD shall have thermal disconnector to interrupt the surge current arising from internal and external faults. Inorder to avoid the fire hazard due to possible DC arcing in the SPD due to operation of thermal disconnector, the SPD shall be able to extinguish the arc.

4.3.6 Environment

The entire inverter cabinet / enclosure (inside& outside) including nuts, bolts etc shall have to be adequately protected/painted for sustainability against harsh environmental conditions for the entire service life.

4.3.7 Modes of PCU & String Inverter

I. STANDBY MODE: -In standby mode the PCU DC & AC contactor are open, inverter is powered on condition and waiting for start command.

II. LOW POWER MODE (AUTO):- 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 after achieving threshold parameters.

III. 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 have trapped into PV array local maximum power point during cloudy atmospheric condition.

IV. 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. During evening and night (non solar generation hours) the PCU shall be in sleep mode in order to minimize the internal power loss. Maximum loss in sleep mode shall be less than 0.05% of PCU rated power.

The above clause is applicable for unity power factor operation/no reactive power support to grid. In case reactive power is required to be supplied to grid, in that case the PCU shall remain connected to grid and supply reactive power as per grid requirement. Inverter shall continuously monitor the output of the PV array and automatically start active power generation when the DC voltage rises above a pre-defined level.

4.3.8 PCU/ String Inverter

The inverter output shall always follow the grid in terms of voltage and frequency. This shall be achieved by sensing the grid voltage and phase and feeding this information to the feedback loop of the inverter. Thus control variable shall then control the output voltage and frequency of the inverter, so that inverter is always synchronized with the grid. The inverter shall be use self- commutated device which shall be adequately rated. The other technical details required are as under.

Nominal Output Frequency	50 Hz
Power Factor Control Range	Operating power factor (adjustable) shall be 0.8 Lead to 0.8 Lag.
Continuous Operating Frequency Range	47.5 Hz to 52 Hz
Input Voltage	1000 V DC (Min)
THD	Less than 4 % at nominal load / as per CEA norms whichever is more stringent
No. of MPPT	Single MPPT or Multi MPPT
Ambient Temperature Range	0^0C to +60^0 C
Output Voltage Tolerance	-10% to +10% of Nominal O/P Voltage
Surge Protection Device (SPD)	Type I & II (DC Side) Type-II (AC Side)
Humidity	95 % Non-condensing
Maximum Noise Level (at 01 m distance)	75 dBA for Indoor type PCU
DC Injection	Less than 0.5% of Nominal Load Current
Flicker	As per IEC 61000
Night SVG (Q at Night)	Required

Active Power Limit Control, Reactive Power and Power Factor Control Feature	Required. Possible from both PPC (if applicable) and SCADA
PCU designed DC Fault Current Level	Maximum Short Circuit Current of PV Array connected to PCU and duration continuous
PCU designed AC Fault Current Level	Maximum Short Circuit Current of LV side of IDT and duration 1 Sec

The Inverter shall have following features:

a. No load loss <1% of rated power and maximum loss in sleep mode shall be less than 0.05%
b. Unit wise & integrated Data logging.
c. Dedicated open protocol Modbus / RS 485 networking
d. Power regulation in the event of thermal overloading:-PCU/ String inverter shall have thermal overloading protection to prevent failure of switching devices (i.e. IGBT) and other components of Inverter. PCU/ String inverter controller shall automatically regulate/limit the power output in order to reduce the inverter cabinet and switching devices temperature. Bidder to submit the PCU/ String inverter power versus ambient temperature curve during details engineering stage. PCU/ String inverter shall be able to provide inverter inside cabinet and IGBT's (switching device) temperature (in soft analog value) to SCADA system for remote monitoring, storing and report generation purpose.
e. Insulation Monitoring of the PV array
f. PV Array Ground fault monitoring &detection to sense discharge current with respect to ground
g. Protection against

- AC/DC Over current
- Synchronization loss protection.
- Over temperature
- AC/DC Overvoltage and under voltage protection
- over & under frequency
- Cooling system failure
- LVRT&HVRT
- Protection against lightning (if required)
- Anti-islanding protection
- Grid monitoring

4.3.9 Earthing of Inverter

The PCU shall be earthed as per manufacturer recommendation. During detail engineering the Bidder needs to submit the details earthing arrangement of PCU and system earth pit requirement. The detail specification for panel earthing for safety has been mentioned elsewhere in this specification

4.4 PERFORMANCE GUARANTEE

The system along with all auxiliaries and accessories shall be capable of performing intended duties under specified conditions. The Contractor shall guarantee the reliability and performance of the individual equipment as well as of the complete system.

4.5 DESIGN AND CONSTRUCTION

4.5.1 Standards

The system and equipment shall be designed, built, tested and installed to the latest revisions of the following applicable standards. In the event of other standards being applicable they will be compared for specific requirement and specifically approved during detailed engineering for the purpose:

S.No.	Standards	Description
1.	IEEE 1547/ IEC 61727/BDEW or Equivalent Standard	Photovoltaic (PV) System – Characteristics of Utility Interface
2.	IEC 61683	Photovoltaic systems – Power conditioners – Procedure for measuring Efficiency
3.	EN 50530	MPPT Efficiency of grid connected PV inverters
4.	IEC 60068-2/ IEC 62093	Environmental Testing
5.	IEC 61000-6-2, IEC 61000-6-4	Electromagnetic Compatibility (EMC)
6.	IEC62109-1&2/ IEC 62103 or equivalent standard.	Safety of power converters for use in PV Power Systems - Particular requirements for Inverters
7.	IEEE1547/IEC 62116/ UL1741 or equivalent EN/BIS Standards	Testing procedure—Islanding prevention measures for power conditioners used in grid connected photovoltaic (PV) power generation systems
8.	IEEE 519	Recommended practices and requirements for Harmonic control in Electrical Power System.
9.	IEC 60529	Ingress Protection Test
10.	Grid Connectivity	Relevant CEA Regulations/ CERC/GERC guideline/ order/ regulation (including LVRT/HVRT compliance) and Grid Code as amended and revised from time to time.

4.6 DRAWINGS, DOCUMENTS AND DESIGN CALCULATIONS

4.6.1 Design Memorandum

The Contractor shall submit to Employer a design memorandum prepared in accordance to clause 1.6 “Record and Documentation” of “Section 1-General Technical Requirements.”

4.6.2 Drawings and Documents

The Contractor shall submit all the drawings and documents in accordance with requirements stipulated in "Section 2 - Technical Documents" of "General Technical Specification (GTS)".

4.6.3 Design Calculation

The Contractor shall submit the design calculation in accordance to Clause 2.4 of "General Technical Specification (GTS)" covering at least the following, for review / acceptance.

- Data/calculations in regard to selection of capacity and size.
- Any other calculations as required during engineering.

4.7 DELIVERY, INSTALLATION AND COMMISSIONING

The Contractor shall follow the requirements of Delivery, Installation and commissioning elaborated in clause 1.7 "Delivery, Installation and commissioning" of "Section 1 - General Technical Requirements."

4.8 SPARE PARTS

Specified/Mandatory spare parts shall be supplied in accordance to clause 1.8 "Spare Parts" of "Section 1 - General Technical Requirements". Specified spare parts to be supplied under this section are as follows:

S.No	Description	Quantity
1	String Inverter with AC Combiner Box (If applicable)	2 % of total quantity used for highest capacity
2	Electronic card for PCU	2% of total quantity used each
3	IGBT unit for PCU	2 % of total quantity used each
4	Semiconductor Fuse	5% (each type and rating) of total qty. used
5	AC Fuse of rating more than 10 Amp	5 nos. of each rating
6	Surge Protection Device for PCU	2% of total quantity for each type (Min 2 no of each type & rating)

4.9 QUALITY ASSURANCE AND TESTING

The Contractor shall follow the quality assurance and testing requirements as per approved "Quality assurance and Testing Specifications (QTS)".

4.10 TYPE TEST

Applicable for both Central and String Inverter

During detail 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 techno- commercial bid opening 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 reports 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.

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5 CABLING SYSTEM

5.1 Scope of Work

Scope of work under this section covers the provision of labour, tools, plants, materials and performance of work necessary for the design, manufacture, quality assurance, quality control, shop assembly, shop testing, delivery at site, site storage and preservation, installation, commissioning, performance testing, acceptance testing, handing over to employer and guarantee for two years of cabling system for Solar Photovoltaic (SPV) Power Plant and as per the specifications hereunder, complete with all auxiliaries, accessories, spare parts and warranting a trouble free safe operation of the installation.

The scope of work shall be a comprehensive functional system covering all supply and services including but not be limited to following:

5.1.1 Cables and Accessories

i) AC and DC System Cables

ii) Control & Instrumentation Cables

iii) Cable terminals, termination kits, cable lugs, cable glands, button tape (strap and stud), and cable junction boxes and all other accessories

iv) Modular type cable trays with connectors, hardware etc

v) Cable ducts, conduits, channel, joints etc.

vi) Spare parts in accordance to clause 5.8 “Spare Parts” of this section.

vii) Tools and instruments in accordance to clause 5.9 “Tools and Instruments” of this section

Any other item(s) not mentioned specifically but necessary for the satisfactory completion of scope of work defined above, as per accepted standard(s) / best international practices.

5.2 Specific Parameters and Layout Conditions

5.2.1 Layout and General Arrangement

1) Three Phase, Medium Voltage (MV) XLPE, power cables shall be required to interconnect the following:

i) 33 kV side of Inverter Duty Transformer or Solar Plant Transformer to 33 kV panel(s) placed in main control room/ 33 kV Main Pooling & Sub Pooling Switchgear Station

ii) 33 kV Panels to Power Transformers (Tie Transformer)

iii) 33 kV Panels to Station Service Transformer(s) (If applicable)

iv) Any other interconnection (s) not mentioned specifically but necessary for the satisfactory completion of scope of work.

2) The 433V/ 240V AC, 220V/ 110V DC, other AC/ DC Systems and solar field DC cables shall be required to connect / interconnect the following in the plant:-

   i) Different auxiliary boards,

   ii) Various distribution boards to local control cubicles/ equipment,

   iii) Interconnection of Modules, String junction/combiner boxes, Inverters, weather monitoring system, tracking system etc

   iv) Pumping system for module washing, drinking water and fire fighting system etc

3) Control and Instrumentation cables shall include all cables required for the installation of the complete instrumentation, control and protection systems in the PV module area, array junction boxes/ String combiner boxes, Inverters, Power Transformers, SST(s), SPT(s),Auxiliary transformer, tracking system and other areas.

5.2.2 Design Considerations

The cables shall be suitable for lying on racks, in ducts, trenches, conduits underground buried installation with chances of flooding with water. Cables should have adequate protection system to withstand the adverse environmental condition of the site. The incoming and outgoing cables of 33 kV panels should be clamped from respective termination and supported properly.

All cables and connectors to be used for installation of solar field must be of solar grade which can withstand harsh environment conditions for 25 years and voltages as per latest IEC standards.

All cables including Ethylene Propylene Rubber (EPR) cables shall be flame retardant, low halogen, low toxicity, and low smoke (FR-LSH) type designed to withstand all mechanical, electrical and thermal stresses developed under steady state and transient operating conditions as specified elsewhere in this specification.

Aluminium/ Copper conductor used in power cables shall have tensile as per relevant standards. Conductors shall be stranded. Conductor of control cables shall be made of stranded, plain annealed Copper.

XLPE insulation shall be suitable for a continuous conductor temperature of 90 deg. C and short circuit conductor temperature of 250 deg C.

The cable core shall be laid up with fillers between the cores wherever necessary. It shall not stick to insulation and inner sheath. All the cables other than single core unarmoured cables shall have distinct extruded PVC inner sheath of black colour as per IS: 5831. Single core cables shall have no Inner sheath as per IS: 7098.

For single core armoured cables, armouring shall be of copper/aluminium wires. For multi core armoured cables armouring shall be of galvanized steel as follows:-

S. No.	Calculated Nominal Diameter of cable under armour	Size and Type of Armour

1	Up to 13 mm	1.4 mm dia GS wire
2	Above 13 mm up to 25 mm	0.8 mm thick GS formed wire/ 1.6 mm dia GS wire
3	Above 25 mm up to 40 mm	0.8 mm thick GS formed wire/ 2.0 mm dia GS wire
4	Above 40 mm up to 55 mm	1.4 mm thick GS formed wire/ 2.5 mm dia GS wire
5	Above 55 mm up to 70 mm	1.4 mm thick GS formed wire/ 3.15 mm dia GS wire
6	Above 70 mm	1.4 mm thick GS formed wire/ 4.0 mm dia GS wire

The aluminium used for armouring shall be of H4 grade as per IS: 8130 with maximum resistivity of 0.028264 ohm-sq. mm/ meter at 20 deg.C. The types and sizes of aluminium armouring shall be same as indicated for galvanised steel.

The gap between armour wires / formed wire shall not exceed one armour wire / formed wire space and there shall be no cross over / over-riding of armour wire / formed wire. The minimum area of coverage of armouring shall be 90%. The breaking load of armour joint shall not be less than 95% of that of armour wire / formed wire. Zinc rich paint shall be applied on armour joint surface of GS wires/formed wires.

The minimum sizes of the Instrumentation and Control cables conductor shall be taken as:

i) 2.5 mm^2 copper for control cable conductor,

ii) 1.5 mm^2 copper for instrumentation/ measurement cable conductor,

iii) 4 core x 6 mm^2 copper for connection between CT junction boxes and panels having red, yellow, blue and black colour cover,

iv) 4 core x 4 mm^2 copper for connection between PT junction boxes and panels having red, yellow, blue and black colour cover.

The minimum number of spare cores in control cables shall be as follows:-

No. of Cores in Cable	**Min. No. of Spare Cores**
2C, 3C	Nil
5C	1
7C – 12C	2
14C & above	3

The cables covered by this specification shall be supplied in one length or in standard length as approved by the Employer.

Cables laid directly (without cable tray/pipe) either underground or overhead shall be of armoured type. The aluminium used for armouring shall be of H4 grade as per relevant IS Code. The armouring shall always

be earthed at one end to ensure that it can not become live if a fault develops within the cable.

Derating Factors:-

Derating factors for various conditions of installations including the following shall be considered while selecting the cable sizes:

(a) Variation in ambient temperature for cables laid in air
(b) Grouping of cables
(c) Variation in ground temperature and soil resistivity for buried cables.

Documents relating to derating factors recommended by the cable manufacturer shall also be submitted.

Cable lengths shall be considered in such a way that straight through cable joints is avoided. No joints shall be allowed in trip circuits, protection circuits and CT/PT circuits. Also joints in critical equipment in main plant area shall not be permitted. Vendor shall identify and accordingly procure the cable drum length

Cable Selection & Sizing:

Cables shall be sized based on the following considerations:

(a) Rated current of the equipment

(b) DC and LT Power cable voltage drop criteria: From Module to Inverter Transformer shall be limited to 3% of rated voltage. For all other LT cables, Maximum Voltage drop shall be limited to 3% of rated voltage.

(c) For HT/MV Cables, the voltage drop in the cable, during motor starting condition, shall be limited to 10% and during full load running condition, shall be limited to 3% of the rated voltage.

(d) Short circuit withstand capability

This will depend on the feeder type. For a fuse protected circuit, cable should be sized to withstand the let out energy of the fuse.

For breaker controlled feeder, cable shall be capable of withstanding the system fault current level for total breaker tripping time inclusive of relay pickup time.

Cable employed for series connection of PV modules through MC4 connectors shall be of 4/6 sq mm size subject to voltage drop value acceptance.

5.2.3 Construction Methodology

5.2.3.1 Fixing of Supports

Wherever the cables are laid in cable trays, the fixing arrangement shall be modular type as approved by the Employer. Strut channels shall be embedded for fixing of the supports and shall be provided, installed and supervised during concreting for correctness of positioning and alignment by the Contractor. Anchor fasteners shall be used wherever required to fix the anchors / supports. Field welding for support system shall not be allowed except fixing of strut channels / supports to embedment. All such welds shall be treated with galvanized compound. Welding to cable trays in any case shall not be allowed.

5.2.3.2 Cable Routing

Cable shall be routed in standard manner through cable trays/ conduits/ RCC Trenches and cable marker to be placed as per the specification mentioned elsewhere in the specification.

For directly buried cables, cable trenches shall be constructed. Construction of cable trench for cables shall include excavation, preparation of sieved sand bedding, riddled soil cover, supply and installation of brick or concrete protective covers, back filling, compacting, supply and installation of route markers and joint markers. Laying of cables and providing protective covering shall be as per IS: 1255. Protection for buried cables, provision for suitable culvert/ hume pipe shall be provided under the motorable roads.

The 33 kV XLPE cables, power and control cables shall be run separately on racks/trays, in cable trenches/cable tunnels and on columns, walls, ceiling and pulled through pipes. The Contractor shall be responsible for carrying out proper dressing of the cables and supply non-magnetic/moulded fiber-glass cable fixing cleats, fasteners and clamps wherever necessary to hold the cables firmly .

Contractor shall take proper care in the handling of cables against external damage of any kind. Necessary rollers etc. shall be used while pulling and laying of the cables. Employer shall have the right to stop the work in case of improper handling of the cables.

Routing of cables shall be optimised to minimise the ohmic losses. Contractor shall submit typical drawings along with tender giving proposed clamping arrangement and give distance of clamping at bends and in regular run of cables.

5.2.3.3 Cable Markers and Cable Binding

(a) RCC cable route and RCC joint markers shall be provided for buried cables route. The voltage grade of the higher voltage cables in route shall be engraved on the marker. Location of underground cable joints shall be indicated with cable marker with an additional inscription "Cable Joint". The marker shall project 150 mm above ground and shall be spaced at an interval of 30 meters and at every change in direction. They shall be located on both sides of road crossings and drain crossings. Top of cable marker/joint marker shall be sloped to avoid accumulation of water/dust on marker.

(b) For cables laid in trays-Suitable cable markers of Aluminium with punch marks shall be provided and suitably tagged to the cable permanently so that cable could be easily identified.

5.2.3.4 Cable Binding/Strapping

All control cables after glanding shall be neatly routed and bonded with the help of cable straps and studs inside the panel. Complete routing in panel shall be such that it gives a neat appearance good workmanship.

For L.T. Power cables, suitable holding clamps will be provided in the panel if required. The Contractor shall do the cable glanding suitable for each cable size at both ends of termination of each cable.

5.3 Rating and Functional Characteristics

The power, control and instrumentation cables shall have the following properties:

i) Oxygen Index — Min. 29 (As per IS 10810 Part-58)

ii) Smoke Density — Min. 40% Light Transmittance,

iii) Acid Gas Emission — Max. 20% by weight (As per IEC-754-I)

iv) Flame propagation shall meet IEC 60332-1, IEEE 383.

5.4 Performance Guarantee

The power and control cabling system along with all auxiliaries and accessories shall be capable of performing intended duties under specified conditions. The Contractor shall guarantee the reliability and performance of the individual equipment as well as of the complete system.

5.5 Design and Construction

5.5.1 Standards

The system and equipment shall be designed, built, tested and installed to the latest revisions of the following applicable standards. In the event of other standards being applicable they will be compared for specific requirement and specifically approved during detailed engineering for the purpose:

S. No.	Standards	Description
1.	IEC 61537	Cable tray systems and cable ladder systems for cable management
2.	IEC 60331	Tests for electric cables under fire conditions
3.	IEC 60332	Test on electric and optical fibre cables under fire conditions
4.	IEC-754 (Part-I)	Test on gases evolved during combustion of electric cables.
5	IEC-332	Test on electric cables under fire conditions.Part-3:Tests on bunched wires or cables (category-B)
6.	IS 1554	Specification for PVC insulated (heavy duty) Electric cables
7.	IS 7098	Specification for cross linked polyethylene insulated PVC sheathed cables
8.	IS 1255	Code of practice for installation and maintenance of power cables up to and including 33kV rating
9.	IS 3961	Recommended current rating of cables
10.	IS 3975	Low carbon galvanised steel wires, formed wires and tapes for armouring of cables

S. No.	Standards	Description
11.	IS 5831	PVC insulation and sheath of electrical cables
12.	EN50618	DC Cables for Photovoltaic System
13	IEC-332	Tests on electric cables under fire conditions.Part-3:Tests on bunched wires or cables(Category-B)
14	ASTM-D-2843	Standard test method for density of smoke from the burning or decomposition of plastics.
15	IS 8130	Conductors for insulated electrical cables & flexible cords.

5.5.2 Cables

5.5.2.1 Power Cables – 33 kV system

The power cable shall be of heavy duty, FR-LSH, stranded circular Aluminium conductor, cross linked polyethylene (XLPE) insulated provided with conductor screening and insulation screening, laid up, extruded PVC inter sheathed and armoured. The insulation and screening shall be extruded, semi-conducting and with copper tape screening (at least 0.075 mm thickness).

5.5.2.2 Power Cables - 650/1100 Volt Grade

These cables single or multicore shall be at least 650/1100 volt grade, heavy duty, FR-LSH, stranded Copper/ Aluminium conductor, cross linked polyethylene (XLPE) insulated and, laid up, extruded PVC inter sheathed.

5.5.2.3 Control and Instrumentation Cables

The control and instrumentation cables shall be multi core, FR-LSH, colour coded/ numbered, annealed stranded high conductivity Copper, single conductor, insulated with PVC insulation and PVC sheathed. The outer sheath shall be of specially formulated PVC compound.

5.5.2.4 DC Cables

The DC cables in a solar PV plant shall be used for interconnecting SPV Modules, from SPV Modules to SCB(s) and from SCB(s) to the Inverter(s). The cables shall be high temperature resistant, robust and suitable for harsh environmental conditions.

DC Cables (Interconnecting SPV Modules and from SPV Modules to SCB/ String Inverter)

Cables used for inter-connecting SPV Modules as well as Modules to SCBs/ String inverter shall be of annealed copper only and shall conform to the requirements of EN 50618:2014 /IS17293:2020 for service life expectancy of 25 years and type test certificate should be submitted for owner's approval. These cables shall also meet the fire resistance requirement as per the above standard and shall be electron beam cured.

All cables except module cable used for (+) ve and (–) ve shall have distinct color identification.

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%. However, in case of necessity to lay more than 8 cables (4 circuits) in one pipe, the same shall be allowed during detailed engineering and as per the derating factors recommended by the cable manufacturer. Fill factor criterion is still to be maintained. Bidder to ensure that there is no gap and proper packing at the junction of two pipes, in which DC cable is laid, using proper method and accessories, like bell mouth.

All cables of Solar module area if laid on cable trays should be covered. The laying of cables shall be as per applicable latest relevant IS code.

DC Cables (String Combiner Box to Inverter)

Cables used between SCB and Inverter shall be of min. 1.5 kV (DC) grade. In case bidder offers 1500V DC system, 3.3 kV (E) grade cables shall be provided. These Power cables shall have compacted Aluminium/copper conductor, XLPE insulated, PVC inner-sheathed (as applicable), Armoured/ Un-armoured, FRL-SH PVC outer sheathed conforming to IS: 7098. These cables shall confirm to the requirements of the standards & codes specified at clause 5.5.1 or any other relevant standard elsewhere in the specification. All other requirement specified for LT Power Cables shall also be applicable to these cables

5.5.3 Colour Scheme and Identification

To facilitate easy identification of phases a colour scheme of red, yellow and blue for phases and black for neutral shall be adopted for power cables. Multi-core control cables shall be colour coded / numbered for identification of cores as per IS: 1554 1988 / IEC.

All the cables shall carry manufacturer data in a permanent, legible manner. The manufacturer's data shall include the name, cable size, word FR-LSH, screen fault current ---KA for ---sec (value of current & time shall be indicated) and voltage rating together with any other information.

Permanent sequential marking to indicate length of the cable shall be embossed at every meter.

5.5.4 Accessories

5.5.4.1 Termination Kit

Termination and jointing kits for 33kV or above, grade XLPE insulated cables shall be of proven design and make which have already been extensively used and type tested. Termination kits and jointing kits shall be heat shrinkable type. Critical components used in cable accessories shall be of tested and proven quality as per relevant product specification/ESI specification. Kit contents shall be supplied from the same source as were used for type testing. The termination and connection of cables shall be done strictly in accordance with cable termination kit manufacturer" instructions, drawings and/or as approved by the employer. Cable jointer shall be qualified to carryout satisfactory

cable jointing/termination. Any other latest type having proven performance in the field can also be accepted subject to approval of Employer.

The Contractor shall supply all hardware consumables such as plumbing metal, sealing compound, tapes and other materials required for the making of these terminal connections of various sizes of cables and should leave at least 5% of these items for future use by the Employer.

5.5.4.2 Cable Lugs

The Contractor shall ensure that no bimetallic action takes place, between the conductor of the cable and the cable-connecting lug by filling the lugs with suitable compound. The lugs shall be of standard quality conforming IEC / IS and of make approved by the Employer.

5.5.4.3 Cable Glands

The cable glands shall be made of brass duly electro tinned in order to avoid corrosion and oxidation of the surface. Glands shall provide neat, tight, dust and vermin proof termination. Gland shall be provided with rubber ring to hold the cables firmly when check-nut is slightly tightened. Gland shall be complete with suitable washers etc.

5.5.4.4 Compression Type Terminals for Control Wiring

These terminals are required for copper conductor of control wiring. They shall be crimped to the conductor while other end will provide flat surface for better connections. The connectors shall be made of Copper electro tinned.

5.5.4.5 Button Tape (Strap and Stud)

This consists of perforated cable strapping with holes conveniently spaced for assembly and moulded studs. The strapping shall be made of NYLON Grade 220 or other elastic material to give proper performance. The studs shall be made of 'NYLON'.

5.5.4.6 Self Adhesive Marker

Self-adhesive marker in the form of strips of any one character, which can be easily peeled from the backing cards and can be applied on the cable, shall be supplied. The strips shall be water- proof duly marked with special formulated ink with specific thermo-setting adhesive to withstand high temperature.

Suitable plastic ring type ferrules marked with engraved indelible ink for control cables and sticker type ferrules for power cables shall be supplied. These shall be marked as per cable schedule such that each core of each cable can be identified easily.

5.5.4.7 Aluminium Strip

Aluminium strip of adequate size for making tags for labels shall be supplied.

5.5.5 Cable Trays and Support Structure

The cable trays including accessories like bends, elbows, tees, cross etc. for indoor applications shall be of perforated (long slots) type, for proper ventilation of the cables, made out of 14-gauge mild steel sheet. The trays shall have minimum 50 mm edge height. The cable trays shall be fully hot dip galvanized.

Supports and screws and bolts for cable trays shall be made of the same materials as the cable trays they support. Tray support system shall be modular type having pre-fabricated sections and supports that can be assembled and bolted for quick and easy installation. Trays provided in tiers shall have minimum 300 mm spacing between tiers.

For outdoor applications ladder type tray with double bends may be used as decided/approved by the employer during detailed engineering.

All the vertical cable trays & the trays which consist of instrumentation cables shall be provided with full covering.

5.5.6 Cable Sealing, Fire & Water Proofing

Modular Multi diameter Cable sealing system consisting of frames, blocks compression wedge and accessories to be installed wherever cables enter/leave/cross walls. All openings in the floor/ roof/ wall/ cable tunnel/ cable trenches made for conduit installation shall be sealed and made water proof either with any proven fire sealing system rated for one hour or Modular multi-diameter cable sealing system consisting of frames, blocks, Compression wedge and its accessories. The Cable sealing system should have been tested for fire insulation for min. 1 hr as per BS 476 and shall also provide water sealing. System shall be anti- rodent and anti- termite

5.5.7 Cable Junction Boxes

Junction boxes shall be mounted at a height of 1200mm above floor level or as specified in the drawings if any and shall be adequately supported/mounted on wall/ structure by means of anchor fasteners/ expandable bolts or shall be mounted on an angle, plate or other structural supports fixed to floor, wall, ceiling or equipment foundations. Junction Boxes with IP: 55 degree of protection shall comprise of a case with hinged door constructed from hot dip galvanised as per relevant IS sheet steel of thickness 2mm. Top of the boxes shall be arranged to slope towards rear of the box. Gland plate shall be 3mm thick sheet steel with neoprene/synthetic rubber gaskets. All junction boxes shall be of adequate strength and rigidity and suitable for mounting on wall, columns, structures etc. The boxes shall include brackets, bolts, nuts, screws M8 earthing stud etc. required for installation.

Receptacle boxes shall be fabricated out of MS sheet of 2mm thickness and hot dip galvanised or of die cast aluminium alloy of thickness of 2.5mm. The boxes shall be provided with two number earthing terminals, gasket to achieve IP 55 degree of protection, terminal blocks for loop in – loop out for cable of specified sizes, mounting brackets suitable for surface mounting on wall/ column/ structure, gland plate etc. The socket shall be shrouded die cast aluminium. Socket shall be provided with lid

safety cover. Robust mechanical interlock shall be provided such that the switch can be put on only when the plug is fully engaged and plug can be withdrawn only when the switch is in off position. Also cover can be opened only when the switch is in off position. Wiring shall be carried out 1100V grade PVC insulated stranded aluminium/copper wire of adequate size.

The terminal blocks shall be of 1100V grade. Terminal blocks shall be of 1100V grade made up of unbreakable polyamide 6.6 grade with adequate current rating and size.

5.5.8 Terminal Blocks

Terminal blocks shall be in accordance to clause 1.5.2.2 “Terminal Blocks” of “Section-1- General Technical Requirements”.

5.6 Drawings, Documents and Design Calculations

5.6.1 Design Memorandum

The Contractor shall submit to Employer a design memorandum prepared in accordance to clause 1.6 “Record and Documentation” of “Section 1- General Technical Requirements.”

5.6.2 Drawings and Documents

The Contractor shall submit all the drawings and documents in accordance with requirements stipulated in “Section 2 - Technical Documents” of “General Technical Specification (GTS)”.

5.6.3 Design Calculation

The Contractor shall submit the design calculation in accordance to Clause 2.4 of “General Technical Specification (GTS)” covering at least the following, for review / acceptance.

i) Calculation for voltage regulation, temperature rise during normal operation and fault level and short circuit calculation for selecting the cable size,

ii) Cable schedule

iii) Optimisation of cable routing for minimising ohmic losses

5.7 Delivery, Installation and Commissioning

The Contractor shall follow the requirements of Delivery, Installation and commissioning elaborated in clause 1.7 “Delivery, Installation and commissioning” of “Section 1 - General Technical Requirements.”

5.8 Spare Parts

In accordance to clause 1.8 “Spare Parts” of “Section 1 - General Technical Requirements”. Specified spare parts to be supplied under this section are as follows:

S. No.	Description	Quantity
1.	33 kV Cable: IDT to Local / Sub Pooling Switchgear Room	Highest size & Longest length (01 Nos)
	33 kV Cable: Local/ Sub Pooling to Main Pooling Switchgear of GSECL	Highest size & Longest length (01 Nos)
	~~33 kV Cable: Pooling Switchgear room to Power Transformer~~	~~Highest size & Longest length (01 Nos)~~
2	415 V Power Cable of each type & size ≥ 6mm2	500 m of each type used
3.	DC Cable (SPV Module to SCB)) (In case of Central Inverter)	2.5 km of each type used
4.	DC Cable (SCB to PCU) (In case of Central Inverter)	700 m of (Highest size)
4A	DC Cable (SPV Module to String inverter) (In case of String Inverter)	700 m (highest size)
5.	Control Cable of each type	300 m of each type used
6	Instrumentation Cable of each type	300 m of each type used
7	Termination Kits - MV/HV (As applicable)	02 no each type

5.9 Deleted

5.9.1 Deleted

5.10 Quality Assurance and Testing

The Contractor shall follow the quality assurance and testing requirements as per approved “Quality assurance and Testing Specifications (QTS)”.

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6 METEOROLOGICAL MEASURING INSTRUMENTS

6.1 Scope of Work

Scope of work under this section covers the provision of labour, tools, plants, materials and performance of work necessary for the design, manufacture, quality assurance, quality control, shop assembly, shop testing, delivery at site, site storage and preservation, installation, commissioning, performance and acceptance testing, training of Employer's personnel, handing over to employer and guarantee for two years of Meteorological Measuring Instruments for Solar Photovoltaic (SPV) Power Plant and as per the specifications hereunder, complete with all auxiliaries, accessories, spare parts and warranting a trouble free safe operation of the installation.

The scope of work shall be a comprehensive functional system covering all supply and services for each plant including but not be limited to following:-

6.1.1 Meteorological Measuring Instruments

Contractor 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.

1. Pyranometers
2. Thermometers
3. Wind Speed Sensor and Wind Direction Sensor

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 shall be from UPS only. All the instruments to be supplied shall have valid calibration certificate.

Proper fencing/ any other suitable arrangement (to be decided during detail engineering), shall be provided around meteorological station where the Pyranometer, Wind, Ambient Temp. Sensor, Data logger etc. are installed.

Bidders are advised to ascertain themselves, the applicable regulation related to weather data which has to be transmitted to control centres like SLDC/RLDC/other agencies (Telemetry). Any signal/parameter/equipment though not specifically mentioned but which are required as per statutory regulation are also included in the scope of bidder.

Any other item(s) not mentioned specifically but necessary for the satisfactory completion of scope of work defined above, as per accepted standard(s) / best international practices.

6.2 Rating and Functional Characteristics

Pyranometer:

Contractor shall provide at least two (02) numbers of secondary standard pyranometer as per ISO 9060 for measuring incident solar radiation for Global Horizontal Irradiance (GHI) and Global Inclined Irradiance (GII).

1	Principle	Thermopile
2	Spectral Response	0.31 to 2.8 Micron.
3	Sensitivity	7 Micro-volt/w/m2
4	Time Response (95%)	Max 15 s
5	Non Linearity	±0.5%
6	Temperature Response	±2%
7	Tilt Error	<±0.5%.
8	Zero Offset Thermal Radiation	±7 w/m2
9	Zero Offset Temperature	±2 w/m2
10	Operating Temperature Range	0 deg to +70 deg.
11	Uncertainty (95% confidence	Hourly- Max-3%/Daily-
12	Non Stability	Max ±0.8%
13	Response Time (95% of Final	<5 sec

Additionally, 01 (one) number second class pyranometer as per ISO 9060 for measurement of Diffuse Horizontal Irradiance (DHI) shall also be supplied.

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.

Output Signal: Analogue form which is compatible with the data. Each instrument shall be supplied with necessary cables. Calibration certificate traceability to World Radiation Reference (WRR) or World Radiation Centre (WRC) shall be furnished along with the equipment. The signal cable length shall not exceed 20m. Contractor shall provide Instrument manual in hard and soft form.

Thermometer:

Contractor shall also provide temperature sensor as given following:

Ambient Air Temperature

One Nos. of RTD type/ semiconductor type ambient temperature measuring instrument. Instrument shall have a range of 0 deg. C to 60 deg. C of accuracy ±0.2 deg. C with operating range 0 to 60 deg C and non-aspirated radiation shield.

Module Temperature Sensor

One Nos. of RTD type/ semiconductor type per 10 MW module temperature sensors shall be fixed on the back of module surface with adhesive or tape without using any mechanical fastener. Instrument shall

have a range of 0 deg. C to 100 deg. C of accuracy ±0.2 deg. C with operating range 0 to 100 deg C.

Inverter Room/ Cabinet

One No. of indoor air temperature sensor RTD type/ semiconductor for each inverter room/ Cabinet and instrument shall have a range of 0 deg. C to 70 deg. C of accuracy ±0.2 deg. C with operating temperature range 0 to 70 deg C.

Wind Speed Sensor and Wind Direction Sensor:

Contractor shall provide at least one number Wind speed sensor and one number Wind direction sensor.The specification is as follows:

Wind Speed Sensor

Sr.	Details	Values
1	Principle	Frequency proportional to wind speed/ Utrasonic sensor
2	Velocity Range	0-60 m/sec
3	Threshold	0.3m/sec
4	Operating Temp	0 to 50 deg C
5	Accuracy	3% (up to 35 m/s), 5 % (above 35 m/s)

Wind Direction Sensor

Sr. No.	Details	Values
1	Principle	Potentiometric type sensor (Resistance proportional to wind direction)/Ultrasonic sensor
2	Range	0-360 deg
3	Accuracy	≤±5 deg
4	Operating Temp	0 to 50 deg C

Relative Humidity (%)

Sr. No.	Details	Values
1	Range	0 to 100 %
2	Accuracy	± 3%
3	Operating Temp	0 to 50 deg C
4	Resolution	1 %

All the instruments to be supplied shall have valid and traceable calibration certificate. Each Pyranometer shall be recalibrated at an interval not more than two years and all other instruments shall be recalibrated at an interval not more than four years.

Additional Measurement

As per 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)
v. Air Density
vi. PV Module performance

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")

PV Analyzer (complete KIT with softwares)

Bidder shall provide minimum 2 Numbers of PV Analyzer Kits of reputed make to measure the PV Module performance. Analyzer kit shall have all necessary hardware connectors and required software for data analysis.

SL No	Details	Values
1	PV Voltage	0-1500 V DC
2	PV Current	0-30 A DC
3	Voltage Accuracy	+/- 0.25 V
4	Current Accuracy	+/- 40 mA
5	Operating Temperature	0-60 Deg C

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 GPC Clock
Data Storage	SD card, Min 2GB for storage of raw and processed data locally at resolution of 1 Second for retrieval whenever required. Data to be stored shall be in unencrypted CSV or equivalent format.
Display	LCD display for easy maintenance and debugging for site engineer

Scan Resolution	3 Sec or better
Analog to Digital Converter (ADC)	16 Bit, Sampling -10 Hz (Min)
I/P Channel	As required with 20 % spare of each type of channel

It shall have facility for arithmetic processing (Time Integration, Simple Average, and Moving Average etc.) of incoming raw data. Data logger shall be interfaced with Solar SCADA on Modbus preferably on TCP-IP. Vendor shall submit Factory Acceptance Test (FAT) report and procedure before dispatch of material to site.

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. Data logger shall have provision to receive redundant power supply.

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.

SOILING STATION

The Soiling Measurement System shall measure the performance loss from a PV array due to accumulation of dust, dirt, and other site-specific contaminants, collectively known as “soiling”. Soiling Stations shall use two full-sized modules. One is allowed to soil naturally, while the other is cleaned with an automatic washing system. Power and energy are monitored for both modules. Bidder scope cover supply of complete system and its installation that includes Data logger, Automatic Module Cleaning System, cabling, software setup and interface with solar SCADA as per the technical requirement mentioned herein.

TECHNICAL REQUIRMENT OF SOILING STATION

The system shall consist of an automatic cleaning system that prevents soiling accumulation on the PV reference module (clean one), another PV module (Soiled one) which is allowed to accumulate soiling at the site-specific rate, an electronic data acquisition and analysis unit.

All components are provided in outdoor rated NEMA 4/IP 65 enclosures for long-term outdoor use. All cables are rated for outdoor use. Following requirements are to be taken care by bidder:-

i) Data logger shall be field tested and shall be in satisfactory operation for a period not less than 6 Months.

ii) Data logger shall be calibrated (Measurement uncertainty less than 2%) before dispatch and calibration shall be traceable to any National/International lab. Data logger shall have flash memory not less than 1GB for local storage of data.

iii) Bidder shall submit the write up detailing the philosophy of measurement of soiling loss in his proposal. Measurement shall be based on comparison of Isc & Power.

iv) Datalogger shall have feature that includes but not limited to Moving Average calibration, Time Integration etc.

v) Bidder to facilitate the interfacing of data of Soiling Station to Solar SCADA on Modbus TCP/IP for trending, storage, retrieval and display of data

Automatic Cleaning System: - The automatic cell-washing system cleans the PV reference module for accurate measurements. The system uses a suitable liquid spray to clean the reference module at user-determined intervals. The liquid tank is minimum 100 Liter. Under typical soiling conditions the liquid reservoir must be refilled periodically using the suitable liquid specified by OEM of Soiling station/PV module supplier. Bidder shall supply 2 Nos of spare spray nozzle along with supply.

Measurements:- The following measurement readouts are available via the Modbus interface: Direct Soiling loss readout shall be available in SCADA for display and recording.

Temperature Rating:- The system shall be rated for operation in ambient air temperatures from -20 °C to 60 °C Any alternate technology proposed by bidder shall be reviewed during detailed engineering stage.

6.3 Performance Guarantee

The system along with all auxiliaries and accessories shall be capable of performing intended duties under specified conditions. The Contractor shall guarantee the reliability and performance of the individual equipment as well as of the complete system.

6.4 Design and Construction

6.4.1 Standards

The system and equipment shall be designed, built, tested and installed to the latest applicable standards. In the event of other standards being applicable they will be compared for specific requirement and specifically approved during detailed engineering for the purpose.

6.5 Drawings, Documents and Design Calculations

6.5.1 Design Memorandum

The Contractor shall submit to Employer a design memorandum prepared in accordance to clause 1.6 “Record and Documentation” of “Section 1-General Technical Requirements.”

6.5.2 Drawings and Documents

The Contractor shall submit all the drawings and documents in accordance with requirements stipulated in “Section 2 - Technical Documents” of “General Technical Specification (GTS)”.

6.5.3 Design Calculation

The Contractor shall submit the design calculation in accordance to Clause 2.4 of “General Technical Specification (GTS)” for review / acceptance.

6.6 Delivery, Installation and Commissioning

The Contractor shall follow the requirements of Delivery, Installation and commissioning elaborated in clause 1.7 “Delivery, Installation and commissioning” of “Section 1 - General Technical Requirements.”

6.7 Deleted

6.8 Spare Parts

In accordance to clause 1.8 “Spare Parts” of “Section 1 - General Technical Requirements”. Specified spare parts to be supplied under this section are as follows:

S. No.	Description	Quantity
1	Pyranometer complete with cables	01 No each for GHI, DHI & GII
2	Data Logger	01 No.

6.9 Quality Assurance and Testing

The Contractor shall follow the quality assurance and testing requirements as per approved “Quality assurance and Testing Specifications (QTS)”.

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7 STRING COMBINER BOX

7.1 Scope of Work

Scope of work under this section covers the provision of labour, tools, plants, materials and performance of work necessary for the design, manufacture, quality assurance, quality control, shop assembly, shop testing, delivery at site, site storage and preservation, installation, commissioning, performance and acceptance testing, training of employer's personnel, handing over to employer and guarantee for two years of String Combiner Box (SCB) for Solar Photovoltaic (SPV) Power Plant and as per the specifications hereunder, complete with all auxiliaries, accessories, spare parts and warranting a trouble free safe operation of the installation.

The scope of work shall be a comprehensive functional system covering all supply and services including but not be limited to following:

7.1.1 String Combiner Box (if applicable)

SCB is used in multi-string photovoltaic systems to combine the individual strings electrically and connect them to the inverters. It shall have protection devices to protect the PV Modules from current/ voltage surges. The no. of strings to be combined to single input of a SCB shall be decided during detail engineering based on approved SLD and the temperature rise calculations.

1000V/1500 V DC system rating shall only be acceptable. SCB offered for 1500V application shall have already been type tested and in satisfactory operation in Solar plant with 1500 V DC system. Voltage rating of the selected component shall be 1500V (Min.) as per system requirement during detail engineering.

Any other item(s) not mentioned specifically but necessary for the satisfactory completion of scope of work defined above, as per accepted standard(s) / best international practices.

7.1.2 General Requirement

SCB shall be equipped (but not limited to) with the following:-

i) Online DC Disconnector/ breaker to disconnect the PV strings from the inverter for maintenance purpose. All components in the SCB shall be suitable for operation within temperature range of 0-65 Deg C.

ii) Fuse in each SCB input (both positive and negative) shall be provided to prevent the reverse short circuit current flow. However, in case of negative string fuse is not required as per recommendation of inverter manufacturer, string cable shall preferably be terminated with field connector with SCB.

iii) Surge Protection device for protection against surge currents and voltages.

iv) Other associated items like cable glands, lugs, vents and items required for the protection and completeness of the system shall be provided.

v) The terminals will be connected to copper bus bar arrangement of proper sizes to be provided. The SCB will have suitable cable entry points fitted with cable glands of appropriate sizes for outgoing cables. Suitable markings shall be provided on the bus-bars for easy identification and UV resistant cable ferrules will be fitted at the cable termination points for identification.

vi) Vendor shall ensure adequate clearance with suitable insulated separator between positive bus and negative bus if it is in same enclosure. Positive and Negative section shall be orientated horizontally (Landscape orientation) on the either side of separator. Separate compartment for negative section and positive section for termination of positive and negative string input shall be preferred.

7.2 Rating and Functional Characteristics

i) The maximum voltage of the PV Plant is in open circuit and the lowest ambient temperature of the PV modules. SCB shall support at least 1000V DC in open circuit without deterioration.

ii) The maximum input current is in short circuit condition and the highest sun irradiance. Regardless the number of inputs, each input shall be rated irradiance of minimum 1000 W/m^2. The reverse-current resistance of the PV modules must be taken into account for solar PV rated fuse sizing.

iii) The design shall ensure an efficient cooling of the fuses to avoid premature aging and unexpected failure of the fuses.

7.3 Performance Guarantee

The system along with all auxiliaries and accessories shall be capable of performing intended duties under specified conditions. The Contractor shall guarantee the reliability and performance of the individual equipment as well as of the complete system.

7.4 Design and Construction

7.4.1 Standards

Connectors, Junction Boxes, Surge Protection Devices, etc. must also conform to the relevant international/ national Standards for Electrical Safety besides that for Quality required for ensuring Expected Service Life and Weather Resistant. The system and equipment shall be designed, built, tested and installed to the latest revisions of the following applicable standards. In the event of other standards being applicable they will be compared for specific requirement and specifically approved during detailed engineering for the purpose:

S. No.	Standards	Description
1.	IEC 62262 / EN 50102	Degrees of Protection provided by enclosures for electrical equipment against external mechanical impacts
2	IEC/EN 60529/ IS 2147	Degree of Protection
3	UL-94V	Fire Resistant/ Flammability for Enclosure
4	UL-746C	UV Resistant
5	IEC/EN61439-1& 2	Low Voltage switchgear and control gear assemblies
6	EN 62208	Empty enclosures for low-voltage switchgear and control gear assemblies
7	IEC 60695-2-11	Glow Wire Test
8	EN50539	Surge Protection
9	IEC61326-1	EMC Certified
10	IEC 60269-6/ UL- 2579	Solar PV application string fuses

7.4.2 Enclosure

SCB Enclosure shall satisfy the following requirement.

i) The enclosure shall be made of fire retardant material with self extinguishing property and free from Halogen, UV Protected. Material of the enclosure shall be made of GRP/FRP/Polycarbonate.

ii) Mechanical impact shall be IK08 or better to protect against impacts as per IEC/EN 62262 or equivalent standard.

iii) The size of the enclosure and general arrangement of the component shall be designed in such a way that the average temperature of enclosure shall not exceed 62 degree C and operating temperature of the components used in that enclosure shall not exceed 72 deg C or OEM recommended temperature limit at ambient temp of 50 deg C for rated load conditions along with spare. The components mounted inside the SCB shall have higher temperature withstand capability and operation/ performance should not be affected due to derating by temperature.

iv) Complete assembled SCB shall be subject to heat run type test to be witnessed by owner after manufacturing. The heat run test to be carried out at 1.25 times the rated current i.e. 1.25 x (Imp of PV Modules) x (no. of string inputs + spare). In case it is found that the temperature rise is beyond the acceptable limits, bidder shall redesign

the assembly and perform the test free of cost to verify that temperature rise is within acceptable limit.

v) In each SCB 5% spare terminals (along with cable glands and fuse) rounded off to next higher integer shall be provided to connect the PV strings.

vi) All terminal blocks shall be rated for min 1000 V/1500V and rated continuously to carry maximum expected current.

vii) If the SCB is proposed to be mounted on ground, suitable canopy shall be provided on top of SCB extending minimum 150 mm from all four sides for protection from direct radiation. Design and dimensions of SCB structure must be such that minimum 600 mm of ground clearance is available below SCB at site for repair and maintenance. The brackets and other erection hardware including mounting accessories shall be made of corrosion resistant material with the appropriate protection for outdoor installation and burial use as per site condition.

viii) All internal wiring shall be carried out with stranded copper wires with voltage rating mentioned elsewhere in the specification. All internal wiring shall be securely supported, neatly arranged readily accessible and connected to component terminals and terminal blocks. Wire terminations shall be made with solder less crimping type of tinned copper lugs which firmly grip the conductor and insulation. Insulated sleeves shall be provided at all the wire terminations. Engraved core identification plastic ferrules marked to correspond with the wiring diagram shall be fitted at both ends of each wire. Ferrules shall fit tightly on wires shall not fall off when the wire is disconnected from terminal blocks.

ix) If metallic hinge is being used with enclosure cover, it shall be made of SS 304 and shall be rust proof. Enclosure shall be provided with captive screws so that its screw doesn't fall off when cover is opened. Screw shall be made of corrosion free material. Suitable non-conducting protection cover shall be provided for any metallic hinge/screw/fastener to avoid contact with live part of the assembly.

x) Mounting plate inside the SCB for mounting/fixing of devices shall be made of FRP/GRP or equivalent non-conducting material.

xi) Degree of protection for enclosure shall be at least IP 66. All the part shall be corrosion resistant and enclosure surface shall be free from crazing, blistering, wrinkling, color blots/striations. There should not be any mending or repair of surface. The SCB if mounted on the floater (applicable for floating solar project) shall confirm to IP-67.

xii) The bottom of the enclosure shall be arranged to allow the passing of the cables while ensuring the IP and the isolation of the enclosure.

xiii) Each enclosure shall be consist of suitable nos of breather glands/plugs to prevent from bulging & shrinking due to change in air volume with respect to temperature and easy opening during low temperature.

xiv) Vendor shall submit the following Type Test/ Product Certification from any National/International accredited lab for approval.

i) Temperature rise test on complete assembled Box as per acceptable limit mentioned in relevant clause.

ii) Type test for enclosure as per code and standard mentioned in relevant clause.

iii) Thermal ageing at 70 Deg C for 96 hours as per IEC 60068-2

iv) HV Test

7.4.3 Protection:

i) STRING FUSES: - All PV inputs shall be protected with fuses and both polarities shall be protected. However in case of negative grounded inverters, string fuse shall be provided in positive leg only as per recommendation of inverter manufacturer. The fuses shall be gPV type and dedicated to solar applications and confirm to IEC 60269-6 or UL-2579 standards and fuse base shall comply to IEC 60269-1. String fuses should also be so designed that it should protect the modules from reverse current overload. Fuse holders shall be suitable for DIN rail mounting. PCB mounted fuses are not acceptable. Fuse rating for single and combined input (limited to two) shall be minimum 15 A and 30 A respectively suitable for 1000/1500 Volt for crystalline module. In case of negative grounded system, requirement of string fuses as well as inverter input fuses on negative side shall be decided based on the recommendation of Inverter (PCU) manufacturer. There should be minimum 10 mm gap between two fuses (fuse holders)..

ii) Overvoltage protection shall be ensured in DC and AC circuits using surge arresters. Surge arresters shall also indicate their end-of-life and replacement shall be possible using removable cartridges.

iii) DC ON-LOAD DISCONNECTOR: - Solar PV On-load Isolator shall be suitable for 1000V or 1500Vdc operational voltage having minimum Insulation voltage of 1500 V dc, in true 2 pole or 3 pole construction with 500Vdc per pole breaking. Any multipolar device achieving this configuration with shorting link (with less than 500Vdc per pole), will not be acceptable. The Isolators shall be type tested to carry the nominal current at rated Voltage till ambient Temperature of 60 Deg C without any de-ration, inside the String Junction box. The Switching part shall necessarily contain reinforced break with an integrated magnetic arc-extinguishing system for the PV arc. The PV isolator need to positive break indication given through a position indication window. The PV Isolator terminals need to be silver plated, and shall comply with IEC 60947-3 and tested for PV application. These shall withstand any PV current and should have no critical current..

iv) DC PLUG-IN CONNECTORS FOR FIELD CABLING: - Field connectors are electrical connectors/coupler used for connecting solar panels and also strings of panels to String combiners box. Cable connector to be used for connecting SPV modules and String monitoring boxes shall be in accordance with IEC 62852: 2014.

Connector shall be of plug and socket design to be plugged together by hand but can be separated again using a tool only. The field connector shall meet the following technical requirement:-

Rated Current, IEC (85°C)	30 A (4 mm^2, 6 mm^2), 40 A (10 mm^2)
Rated Voltage	1000/1500 V (Min)
Connector Design	Snap-In locking Type
Protection Degree	IP68 (Mated)
Ambient Temperature	(-) 40deg C to (+) 85deg C
Protection/Safety Class	Class II
Contact material	Cu
Contact surface material	Silver/Tin
Contact resistance for plug connecter	< 0.5 milli-ohms
Stripping length	10 mm
Inflammability Class	UL 94-V0
Insulating Material	PPE / PPO/Polyamide
Pollution degree	3
Certification	UL/TUV/CSA/EAC or Equivalent

Vendor shall submit the following Type Test/ Product Certification from any National/International accredited lab for approval.

a. Protection Degree (IP)

b. Operating Temperature

c. Inflammability

d. Pollution Degree

e. Voltage Withstand (Rated Voltage/Test Voltage)

f. Product Certification

v) DC SURGE PROTECTION DEVICES (SPD):- Each SCB shall be provided with properly rated surge protection device (SPD).SPD shall be provided with Metal Oxide Varistors (MOV) type surge arrestors which shall be connected from positive and negative bus to the earth. The protective earth conductor should be taken directly from the earth grid not from the structure frame. The discharge capability of the SPD shall be at least 12.5kA at 8/20 micro second wave as per IEC 61643-12 and shall be rated for MCOV 1000/1500 Volt DC. During fault and failure of MOV, the SPD shall safely disconnect the healthy system.SPD shall have thermal disconnector to interrupt the surge current arising from internal and external faults. In order to avoid the fire hazard due to possible DC arcing in the SPD due to operation of thermal disconnector, the SPD shall be able to extinguish the arc. SPD shall have local visual indication.

7.4.4 Deleted

7.4.5 Operating Condition:

i) SCB shall be corrosive resistant and should not sensitive to the salty/ foggy weather condition.

ii) Suitable markings shall be provided on the bus bar for easy identification and cable ferrules shall be fitted at the cable termination points for identification and securely supported. All internal wiring shall be carried out with stranded copper wires. Wire terminations shall be made with solder less crimping type of tinned copper lugs with firmly grip the conductor and insulation. Insulated sleeves shall be provided at all the wire terminations. Engraved core identification plastic ferrules marked to correspond with the wiring diagram shall be fitted at both ends of each wire. Ferrules shall fit tightly on wires shall not fall off when the wire is disconnected from terminal blocks.

7.4.6 Safety and Compliance

i) SCB shall meet the safety standard IEC/EN 61439-1 and -2 "Low-voltage switchgear and control gear assemblies"

ii) The enclosure shall also carry a permanent warning label in Hindi & English indicating that active parts inside the boxes may still be live after isolation.

7.5 Drawings, Documents and Design Calculations

7.5.1 Design Memorandum

The Contractor shall submit to Employer a design memorandum prepared in accordance to clause 1.6 "Record and Documentation" of "Section 1- General Technical Requirements."

7.5.2 Drawings and Documents

The Contractor shall submit all the drawings and documents in accordance with requirements stipulated in "Section 2 - Technical Documents" of "General Technical Specification (GTS)".

7.5.3 Design Calculation

The Contractor shall submit the design calculation in accordance to Clause 2.4 of "General Technical Specification (GTS)" for review / acceptance.

7.6 Delivery, Installation and Commissioning

The Contractor shall follow the requirements of Delivery, Installation and commissioning elaborated in clause 1.7 "Delivery, Installation and commissioning" of "Section 1 - General Technical Requirements."

7.7 Spare Parts

Specified/Mandatory spare parts shall be supplied in accordance to clause 1.8 “Spare Parts” of “Section 1 - General Technical Requirements”. Specified spare parts to be supplied under this section are as follows:

S.No.	Description	Quantity
1	String Combiner Box	1% of used quantity
2	Surge Protection Device	1% of total population
3	Junction Box fuses / blocking diode (as applicable)	1% of total population (each type)

7.8 Tools and Instruments

The Contractor shall supply all necessary tools and instruments etc. at each plant location for installation, repair and maintenance in accordance to clause 1.9 “Tools and Instruments” of “Section 1 - General Technical Requirements”.

S.No.	Description	Quantity
1	Digital Tong Tester	1 No.
2	Digital Multimeter with graphic display	1 No.

7.8.1 Deleted

7.9 Quality Assurance and Testing

The Contractor shall follow the quality assurance and testing requirements as per approved “Quality assurance and Testing Specifications (QTS)”.

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8 POWER TRANSFORMERS

8.1 Scope of Work

Scope of work under this section covers the provision of labour, tools, plants, materials and performance of work necessary for the design, manufacture, quality assurance, quality control, shop assembly, shop testing, delivery at site, site storage and preservation, installation, commissioning, performance and acceptance testing, training of Employer's personnel, handing over to Employer and guarantee for two years of power transformers for Solar Photovoltaic (SPV) Power Plant as per the specifications hereunder, each complete with all auxiliaries, accessories, spare parts and warranting a trouble free safe operation of the installation.

The requirement of power transformer(s) shall be as per system requirement. The scope of work shall be a comprehensive functional system covering all supply and services including but not be limited to following:-

8.1.1 Power Transformer

i) 01 No, 40 MVA (Min), 33 kV/ 220 kV, ONAN, Three phase Power transformer(s) complete with all necessary items such as bushings, undercarriage, current transformers, instrumentation, valves, piping, mounting plates, hardware, fittings, cable trays, marshalling box accessories etc. The Transformer specification and other technical requirements shall be as per "Standard Technical Specifications of Transformer(s) for solar park Pooling Station" issued by CEA and amendments thereof.

ii) The transformers shall be designed to carry at least 10% overload for minimum six hours.

iii) One (1) set of embedment and hardware for installation of the above transformers in switchyard.

iv) Fire protection system & fighting arrangements as specified in section of "Fire Fighting System".

v) Protection Relays as specified in section of "Protection System".

vi) One (1) set of piping required for oil water separator and soak pit including, water level detectors and automatic pumping facility to maintain the pit empty and available for emergency as per norm

vii) Coordination and provision of necessary contacts and/or ports for integration with plant SCADA system,

viii) Spare parts in accordance to clause 8.8 "Spare Parts" of this section.

ix) Tools and instruments in accordance to clause 8.9 "Tools and Instruments" of this section

Any other item(s) not mentioned specifically but necessary for the satisfactory completion of scope of work defined above, as per accepted standard(s) / best international practices.

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8.2 Specific Parameters and Layout Conditions

8.2.1 Layout and General Arrangement

The power generated by plant will be stepped up to 220kV level by 33 / 220 kV three phase step-up transformers. The transformers shall be located in switchyard area.

The power transformers shall be of proven design for intended duty specified to ensure a high reliability and availability. The power transformers shall be suitable and design shall be capable to withstand frequent start and stop sequence.

Transformer LV side shall be connected to the respective 33 kV outgoing panel through 33 kV XLPE cable. A suitable Oil / Air bushing at LV end of the transformer shall be provided.

The HV and LV sides of the transformer shall have star formation with neutral directly grounded through insulated support from tank to the ground level at a convenient point with 2 nos. copper flat. Flexible expansion joints should be provided for terminating the earth strips to neutral bushing. HV side shall be connected to 220 kV Bus through overhead conductors.

The transformers shall be oil-immersed with ONAN cooling.

All the control and instrumentation panels / devices shall be so arranged that these are easily visible and conveniently and safely accessible from the front.

8.2.2 Operating Conditions

8.2.2.1 Normal Operation

Normal operation shall be defined as operation with operating parameters within the following ranges:

Sl. No.	Grid Parameter	Normal Range
1	HV and LV side Voltage	90 % to 110 % of Rated value
2	Frequency	47.5 Hz to 52.5 Hz
3	Power Factor	0.9 overexcited to 0.9 under excited

8.2.2.2 Over Fluxing Requirement

The over fluxing requirements are the following:

i) $\frac{U}{Ur} / \frac{f}{fr} \leq 1.1$ in a continuous functioning mode

ii) $\frac{U}{Ur} / \frac{f}{fr} \leq 1.25$ during 1 minute of functioning

iii) $\frac{U}{Ur} / \frac{f}{fr} \leq 1.4$ during 5 sec of functioning

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Wherein Ur – Rated Voltage; U – Operating Voltage

fr – Rated Frequency; f – Operating Frequency

Withstand time for 150% & 170% over fluxing condition shall be indicated. Over fluxing characteristics up to 170 % shall be submitted.

8.2.2.3 Switch-on

Normally the transformer shall be switched on from LV side i.e., generating end but during non-generating period it shall be required to charge the transformer from HV side to feed the station load through 33 kV bus and to made grid supply available at PCU / inverter terminals for control & monitoring functions. However, the transformer shall also be able to be directly energized by switching on from HV side without the use of a line choking coil and without damage or other adverse effect on the transformer while the grid operating parameters are within the following values:

Sr.No.	Grid Parameter	Range for Synchronizing
1	HV side voltage	80 % to 110 % of Rated Voltage
2	Frequency	47.5 Hz to 52.5 Hz

8.2.2.4 Switch-off

It shall be possible to switch-off simultaneously any one or combination of the plant parts either manually or automatically whatever may be the operating condition of plant. The Contractor shall take into account the worst-case situation when calculating either LV or HV side over voltages on the transformer. The transformer shall be able to withstand without damage such over voltages or an under voltage, at least equal to 1.4 times the rated voltage at the terminals for a duration of 5 seconds, whichever is worse.

8.3 Ratings and Functional Characteristics

1	Kind of Transformer	Separate Winding
2	No. of Phases	Three
3	Installation	Outdoor
4	Rated Continuous MVA at Maximum Ambient Temperature of 50.0°C	1 x 40 MVA (Min)
5	Minimum % Impedance at Rated MVA and Rated Frequency	As per IS 2026
6	Type of Cooling	ONAN
7	Winding Material	Copper
8	Type of Conservator	Air Bag Type
9	Maximum Flux Density at Rated Voltage and Frequency	Not to exceed 1.65 Tesla

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10	**Connection of Transformer**	
(a)	HV Winding	Star with neutral directly earthed
(b)	LV Winding	Star with neutral directly earthed
(c)	Vector Group	As per system requirement
11	**Type of Bushing**	
(a)	HV Terminal	Oil / Air Bushing
(b)	LV Terminal	Oil / Air Bushing
(c)	Neutral Terminal	Oil / Air bushing
12	Rated Frequency, Fr	50 Hz
13	Voltage Ratio	33/ 220 kV
14	**Nominal Voltage, Ur**	
(a)	H.V. Winding	220 kV
(b)	L.V. Winding	33 kV
15	**Highest Voltage, Um**	
(a)	H.V. Winding	245 kV
(b)	L.V. Winding	36 kV
16	**Power Frequency Withstand Voltage**	
(a)	HV Winding / HV Bushing	395/505V (r.m.s)
(b)	LV Winding/ LV Bushing	70/77 kV (r.m.s)
©	HV Neutral Bushing / LV Neutral Bushing	77 kV/ 77 kV (r.m.s)
(d)	HV Neutral Winding/ LV Neutral Winding	38 kV/ 70 kV (r.m.s.)
17	**Lightning Impulse Withstand Voltage**	
(a)	H.V. Winding / H.V.Bushing	950kV/ 1050kV(Peak)
(b)	L.V. Winding/ LV Bushing	170/170 kV (Peak)
(c)	H.V. Neutral Bushing / L.V Neutral Bushing	170/ 170 kV (Peak)
(d)	H.V. Neutral Winding/ L.V. Neutral Winding	95/ 170 kV (Peak)
18	Switching Impulse Withstand Voltage of H.V Winding	750kV (Peak)
19	**Minimum Creepage Distance in Air**	
(a)	H.V. Bushing	7595 mm
(b)	L.V. Bushing, HV & LV Neutral	1116 mm

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20	Short Circuit Current on HV side (1 Sec)	50 KA
21	Short Circuit Apparent Power	As per Table-2 of IEC 60076-5
22	**Maximum Temperature Rise with a reference to Maximum Ambient Temperature of 50.0°C**	
(a)	Top Oil (Measured by Thermometer)	50°C
(b)	Winding (Measured by Resistance Method)	55°C
23	**Insulation**	
(a)	H.V. Winding	Class A (Winding insulation shall be able to withstand 245 kV continuously
(b)	L.V. Winding	Class A (Uniformly insulated)
24	Voltage Withstand Capacity during sudden disconnection of load	1.4 times the rated voltage for 5 seconds
25	Noise Level	As per NEMA TR- 1 standard
26	**H.V. Line Bushing CT**	
(a)	CT Ratio	As per system Requirement
(b)	No. of CT cores for each phase of Transformer	2
(c)	Accuracy Class	PS
27	**H.V. Neutral Bushing CT**	
(a)	CT Ratio	As per system Requirement
(b)	No. of CT cores for each phase of Transformer	2
(c)	Accuracy Class	PS
28	**L.V. Neutral Bushing CT**	
(a)	CT Ratio	As per system Requirement
(b)	No. of CT cores for each phase of Transformer	2
(c)	Accuracy Class	PS

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8.4 Performance Guarantee

The Power transformers along with all auxiliaries and accessories shall be capable of performing intended duties under specified conditions. The Contractor shall guarantee the reliability and performance of the individual equipment as well as of the complete system.

8.4.1 Guaranteed Losses

The no load loss in kilowatts at rated voltage and rated frequency, load losses and total loss in kilowatts at rated output, rated voltage and rated frequency shall be guaranteed.

8.5 Design and Construction

8.5.1 Standards

The system and equipment shall be designed, built, tested and installed to the latest revisions of the following applicable standards. In the event of other standards being applicable they will be compared for specific requirement and specifically approved during detailed engineering for the purpose:

S.No.	Standards	Description
1	IEC 60076, IS:2026, IS:6600	Power Transformers
2	IS:2099, IEC:60137, IS : 3347	Insulated bushings for alternating voltages above 1000 V
3	IEC 60044 -1	Current Transformers.
4	NEMA TR-1	Transformers, Regulators and Reactors
5	IEC 60186	Voltage Transformers
6	IEC 60404-2	Methods of measurement of the magnetic properties of electrical steel sheet and strip by means of an Epstein frame
7	IEC 60296	Specification for unused mineral insulating oils for transformer and Switchgear.
8	IEC 60354	Loading guide for oil immersed power transformers

8.5.2 Core

The cores shall be constructed from high grade Cold Rolled Non Ageing Grain Oriented Silicon Steel Laminations. Adequate lifting lugs shall be provided to enable the core and windings to be lifted. Adequate provision shall be made to prevent movement of the core and winding relative to the tank during transport and installation or while in service.

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The supporting framework of the cores shall be so designed as to avoid the presence of pockets, which would prevent complete emptying of the tank through the drain valve, or cause trapping of air during filling.

8.5.3 Windings

The winding shall be designed to withstand the highest system voltage continuously.

The insulation of transformer windings and connection shall be free from insulating composition liable to soften, ooze out, shrink or collapse and be non-catalytic and chemically inactive to transformer oil during service.

The stacks of windings shall receive adequate shrinkage treatment before final assembly. Adjustable devices shall be provided for taking up any possible shrinkage of coils in service.

The coil clamping arrangement and the finished dimensions of any oil ducts shall be such as will not impede the free circulation of oil through the ducts. The edges of copper conductor shall be smooth so as to ensure that the vibrations do not damage the paper wrapped leading to a fault.

8.5.4 Bushings and Termination Arrangements

8.5.4.1 Bushings

All the HV, LV & Neutral bushing shall be supplied as per system requirement. A stress shield shall be considered as an integral part of bushing assembly. Current transformer, where required, shall be provided and the bushings shall be independently supported to ensure secure removal of bushings without disturbing the current transformer secondary terminals and connections.

Test point shall be provided on condenser bushings for measurement of capacitance and Tanδ.

8.5.4.2 Termination Arrangement

The Contractor shall co-ordinate the interface arrangement and scope of supply with respective manufacturers for:

i) 33 kV XLPE termination on 33 kV side of transformer as per standard

ii) Overhead conductor termination on 220 kV side of the Transformer as per standard

8.5.5 Tank

8.5.5.1 Construction

The transformer tank and cover shall be fabricated from good commercial grade low carbon steel. The tank construction shall be welded type and the cover shall be bolted to the tank. All joints, which may have to be opened from time to time in the course of operation, shall be designed to permit their being made oil-tight during reassembly easily. The tank shall be reinforced by stiffeners of structural steel for general rigidity. The tank

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shall have sufficient strength to withstand, without permanent distortion, during

i) Filling under vacuum,

ii) Continuous internal gas pressure of 0.35 atmosphere with oil at operating level,

iii) Short circuit forces,

iv) 180° Out of phase synchronisation forces,

v) Mechanical shocks during transportation in fully assembled and in oil filled condition.

At least two manholes with bolted cover shall be provided on the tank cover for inspection and connection. The manhole shall be of sufficient size to afford easy access to the lower end of the bushings, core and coil. Suitable numbers of hand holes shall be provided to access the lower end of all bushing connections, and other parts required to be inspected during maintenance.

All bolted connections to the tank shall be fitted with suitable oil tight gaskets.

The transformer tank, fittings and all accessories shall be designed to withstand seismic acceleration as elaborated in clause “Seismic Design” of “Section 1 - General Technical Requirements.”

The tanks of all transformers shall be designed so as to allow complete transformer with all accessories and filled with oil, to be lifted by jacks and local movement in transformer area, without overstraining any joints and without causing subsequent leakage of oil.

The transformer tank shall be equipped with at least the following valves of appropriate size with standard screw connections for external piping:

a) One upper oil filling valve (inlet) with vacuum attachment,

b) One drain valve (outlet) for complete drainage of the tank with padlocking arrangement,

c) One filter valve shall be located at the top of the tank. The opening of this valve shall be baffled to prevent aeration of the oil and shall have padlock arrangement,

d) One filter valve shall be located near the bottom of the tank,

e) Two oil sampling valves, one at top and one at bottom of main tank,

f) Expansion joints, NRVs and isolating valves shall be provided for maintaining pumps without outage of transformer,

g) Port with valve for measurement of dissolved gases through portable DGA test set,

h) One valve at the bottom of tank for on line moisture and dissolved hydrogen monitor instrument maintenance.

All bolts and nuts used in connection with the tank and fittings shall be hot dip galvanized /electro-galvanized.

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As far as possible the transformer tank and its accessories shall be designed without pockets where gas may collect. Where pockets cannot be avoided, pipes shall be provided to vent the gas off.

8.5.6 Transformer Movements

The transformer tank shall be provided on strong structural steel base equipped with single flanged wheels suitable for moving the transformer completely assembled and oil filled.

Tank shall be provided with jacking pads. It shall be possible to change the direction of the wheel through 90 degree when the transformer is lifted on jacks to permit movement of the transformer along its longitudinal or transverse axis on standard broad gauge tracks in both the longitudinal and transverse directions. Suitable locking arrangement shall be provided for wheels to prevent accidental movement of transformer.

Rail section shall be of 45 Kg/m or higher. All embedment and hardware for installation of rail shall be in the scope of the Contractor.

8.5.7 Internal Earthing Arrangement

8.5.7.1 Earthing of Core Clamping Structure

The top main core clamping structure shall be connected to the tank body by a copper strap. The bottom clamping structure shall be earthed by one or more of the following methods:

i) By connection through vertical tie rods to the top structure,

ii) By direct metal-to-metal contact with the tank base maintained by the weight of the core and windings,

iii) By a connection to the top structure on the same side of the core as the main earth connection to the tank

8.5.7.2 Earthing of Magnetic Circuit

The magnetic circuit shall be earthed to the clamping structure at one point only, through a link placed in an accessible position beneath an inspection opening in the tank cover. The connection to the link shall be on the same side of the core as the main earth connection. The connections are to be brought out through a bushing for the convenience of measurements.

8.5.7.3 Earthing Terminal

Two earthing terminals capable of carrying the short circuit current of the transformer for four second shall be provided. Provision shall be made at position close to each of bottom two corners of the tank for bolting the earthing terminals to the tank to suit the local conditions.

8.5.7.4 Earthing of Coil Clamping Rings

Where coil-clamping rings are of metal at earth potential, each ring shall be connected to the adjacent core clamping structure on the same side of transformer as the main earth connections.

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8.5.8 Conservator Vessel, Oil Gauge and Breather

Air cell type conservator i.e. oil in conservator shall be separated from atmosphere by an air cell made of flexible urethane or nitrile rubber, reinforced with nylon cloth. All the material used shall be suitable for operating continuous at 105°C.

Conservator complete with drain valve will have capacity to meet the requirement for expansion of the total cold oil volume in the transformer and cooling equipment from the minimum ambient temperature to 105°C. The conservator shall have sufficient strength to withstand, without permanent distortion, during filling under vacuum.

The conservator shall have two filter valves one at the bottom at one end and other at the top on the opposite end.

One number magnetic type oil gauge with low level alarm contacts shall be provided.

Each conservator vessel shall be fitted with two breather in which silica gel is the de-hydrating agent and designed so that:

i) The passage of air shall be such that it is first filtered through oil bath and then shall pass through silica gel with 100% redundancy through selector valves - i.e two (2) silica gel breather in series.

ii) The external atmosphere is not continuously in contact with the silica gel.

iii) The moisture absorption indicated by a change in colour of tinted crystals can be easily observed from distance.

iv) All breathers shall be mounted at approximately 1400 mm above ground level.

8.5.9 Gas and Oil Actuated Relay (Buchholz Relay)

Each transformer shall be fitted with gas and oil actuated relay having alarm and trip contacts, which close following oil surge or low oil level conditions.

Each gas and oil actuated relay shall be provided with a test cock to take flexible pipe connection for checking the operation of the relay and sampling of accumulated gases.

To allow gas to be collected at ground level, a pipe shall be connected to the gas release cock of the gas and oil actuated relay and brought down to a point approximately 1.25 m above ground level, where it shall be terminated by a cock.

The design of the relay mounting arrangement, the associated pipe work and the cooling plant shall be such that mal-operation of the relays shall not take place under normal service conditions.

8.5.10 Current Transformer

Bushing or turret mounted current transformers shall be provided. It shall be possible to remove the CTs from the transformer tank without removing the transformer cover. CT secondary leads shall be brought out

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to a weather-proof terminal box near the bushings and the wiring from terminal box to marshalling box shall be done.

8.5.11 Neutral Formation

Neutral formation for three phase transformers shall be done shall be done as per standard manufacturing practice. The neutral CT for restricted earth fault protections shall be mounted on the transformers vault. The scope of neutral formation including support insulators, hardware up to earthing point including neutral CT shall be in the scope of the Contractor. The neutral brought down along the body of transformer shall be earthed to two bars of the earth mat below the pit.

8.5.12 Valves

All valves shall be heavy duty Gate type made of stainless steel material.

Means shall be provided for pad-locking the critical valves in the open and close positions.

8.5.13 Pressure Relief Device

The pressure relief device, specifically designed for transformer protection, shall be provided for protection from internal overpressure. The no. of devices shall be worked out according to the volume of oil. The device shall be of spring loaded type and shall be equipped with 2 no. contacts for further incorporation into control and protection system. The device shall be fast acting type and full opening shall occur within 2 ms in case of overpressure above set point. The discharge of PRD shall be properly taken through pipes and directed away from the transformer / other equipments.

8.5.14 Locking Arrangement

All valves, ladder and other devices vulnerable to accidental operation shall be suitable for safety of installation. Locking with the help of nuts, bolts and other hardware shall be provided for authorised operation of devices.

8.5.15 Anti-Earthquake Clamping Devices

Each transformer shall be rigidly mounted on wheels resting on rails, grounded in concrete foundations. The complete transformer shall be rigidly anchored through assemblies to the foundations using anti earth quake clamping and locking devices. The scope of supply shall include the requisite foundation bolts/clamping bolts and locking devices and all other accessories.

8.5.16 Marshalling Box

Sheet steel, vermin proof, weather and dust proof marshalling box shall be provided with each transformer, to accommodate:

i) Temperature indicators,

ii) Control and protection equipment for the cooling plant,

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iii) Selector switches, contacts for annunciation, terminal blocks for CT connection etc,

iv) Terminal glands and gland plates for incoming and outgoing cables

The temperature indicator shall be so mounted that the dials are not more than 1600 mm from the ground level and shall be visible without opening the marshalling box.

The box shall have on one side two hinges and second side locking arrangement, which can be duplicated. The box shall be minimum IP 55 class of protection.

To prevent internal condensation, an approved type of metal-clad heater shall be provided, controlled by a suitable switch and thermostat. Disconnecting type links shall be provided for CT terminations.

8.5.17 Control Wiring

All controls, alarms, indicating and relaying devices and secondary terminals of CTs provided with the transformer shall be wired up to the terminal blocks inside the marshalling box. The wiring shall be from PVC insulated copper cable of 1100V grade. All the control wiring shall be properly routed through perforated & covered cable tray fixed on the tank.

8.5.18 Joints and Gaskets

All gaskets used for making oil tight joint shall be of proven material such as granulated cork, bonded with synthetic rubber.

8.5.19 Fittings and Accessories

8.5.19.1 General

Each transformer shall be provided with the following fittings and accessories as per details given below / preceding sub-clauses:

i) One Dial type Indicating Thermometer for Oil

ii) One Dial Type Winding Hot Spot Temperature Indicator, in the hottest winding of the transformer shall be provided. This shall be of indicating type, responsive to the combination of top oil temperature and winding current, calibrated to follow the hottest spot temperature of the transformer winding.

iii) RTDs for Winding and Oil temperature for remote measurement

iv) Spare RTDs for Winding and Oil temperature for remote measurement (embedded in the winding/oil)

v) One number Direct Hot Spot Measurement System as detailed at clause no. 8.5.19.2

vi) Pocket on Tank cover for Thermometer.

vii) One number Magnetic Type Oil Gauge with low level alarm contact.

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viii) Gas and Oil Actuated Relay (Buchholz Relay) with alarm and trip contacts

ix) Oil Preservation System complete with air cell type conservator, two numbers Silica Gel Breather (with 100% standby capacity) with oil seal and selector valves for selecting one and isolating the other

x) Adequate number of Pressure Relief Devices

xi) Air Release Devices at required locations

xii) Two earthing terminals along with bolt and spring washers

xiii) Marshalling Box for housing control equipment and terminal connections

xiv) Complete wiring up to the marshalling box with PVC copper cables of 1100 V grade. Wiring shall be brought through designated steel conduit pipe properly clamped on the tank.

xv) Inspection covers.

xvi) Valves

a) Oil valves in the main tank and in the cooling system,

b) Drain valve with padlocking arrangement,

c) Two filter valves on diagonally opposite ends one at the top and the other at the bottom with padlocking arrangement on the bottom valve,

d) Two sampling valves one at the top and another at the bottom,

xvii) Diagram and rating plate, Valve position indicating plate, Cooler diagram plate.

xviii) Jacking pads for jacking the transformer for changing direction of rotation of bi-directional wheels

xix) Lifting lugs for lifting the complete transformer assembly filled with oil.

xx) Lifting eyes or lugs on all parts of the transformer requiring independent handling during assembly and dismantling.

xxi) Skids and Pulling eyes on both sides

xxii) Bi-directional flange rollers with locking and bolting device

xxiii) Anti earthquake clamping devices

xxiv) Bushing mounted CT's and Neutral CTs.

xxv) Port with valve for measurement of dissolved gases through portable DGA test set.

8.5.19.2 Deleted

8.5.20 Insulating Oil

The Transformer oil shall be of predominantly naphtha based mineral type. The transformers and all associated oil-filled equipment shall be

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supplied along with the first filling of oil and ten (10) percent of total quantity of oil to be used for filling (based on quantity mentioned on the rating plate rounded off to full drum nos. on higher side) in non-returnable drums. The oil shall be free from moisture and have uniform quality throughout.

8.5.20.1 Oil Characteristics

The oil shall be free from PCBs (polychlorinated biphenyls) and have uniform quality. The parameters of new oil at the time of despatch of oil from refinery/manufacturer works shall confirm to IS 335-1994, IEC 60296-2003 where ever applicable, considering stringent values in case of overlapping standard/ references. No inhibitor shall be used in oil.

The other parameters of oil before filling in the transformer tank shall be limited to following:

i)	Break Down Voltage (BDV)	70 kV at 2.5 mm gap
ii)	Moisture Content	less than12 ppm
iii)	Gas Content	less than 0.1% by volume

8.6 Drawings, Documents and Design Calculations

8.6.1 Design Memorandum

The Contractor shall submit to Employer a design memorandum prepared in accordance to clause 1.6 “Record and Documentation” of “Section 1-General Technical Requirements.”

The technical details would include but not limited to – details of core construction, insulation of yoke clamps – leg plates – core laminations, flux shields, flux density at rated voltage and frequency for limb-yoke-shields, winding type, conductor insulation, oil circulation including velocity in windings, duct sizes adopted, short circuit capability, current density in winding and in earth fault conditions and maximum partial discharge expected.

8.6.2 Drawings and Documents

The Contractor shall submit all the drawings and documents in accordance with requirements stipulated in “Section 2 - Technical Documents” of “General Technical Specification (GTS)”.

8.6.3 Design Calculation

The Contractor shall submit the design calculation in accordance to Clause 2.4 of “General Technical Specification (GTS)” covering at least the following, for review / acceptance.

i) Temperature Rise,

ii) Size of Cooling System,

iii) Ability to withstand Short Circuit, Design Review in respect of ability to withstand dynamic effect of short circuit for power transformers,

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iv) Design of oil Soak Pit with gravity based Oil Water Separator Arrangement

v) Confirmation in respect of the capability as per clause no. 8.2.2.3 & 4 of this section for Switch on and switch-off

8.6.4 Design Review

Design review would consist of review of design by comparison with a similar reference transformer, which has passed a short circuit of similar or higher magnitude successfully.

The document to be provided by the manufacturer for the purpose of design review shall include, but not limited to, following items:

i) Electromagnetic design data sheet as needed for calculation to demonstrate maximum axial thrust for worst fault conditions for each winding and minimum winding and support short circuit thrust for each winding

ii) Drawings or sketches of the complete winding and insulation arrangement within the core window with indication of the types of the material,

iii) Calculation of short circuit current values (both peak and symmetrical RMS values) affecting each single winding as a result of the service duty requirements specified and types of fault taken into consideration,

iv) Calculation of the main short circuit forces (peak values occurring at the highest peak of the respective current) with reference to the fault cases and geometrical and relative positions of windings considered for the purpose of design,

v) Full information in simplified geometrical configuration is expected to be provided for windings, core and tank for the purpose of magnetic leakage field and electromagnetic force calculations.

Axial short circuit forces for core type and radial short circuit forces for shell type shall be dealt to the entire satisfaction of purchaser.

8.7 Delivery, Installation and Commissioning

The Contractor shall follow the requirements of Delivery, Installation and commissioning elaborated in clause 1.7 “Delivery, Installation and commissioning” of “Section 1 - General Technical Requirements.”

8.7.1 Specific Packaging, Handling and Storage Requirements

After completion of all the testing at shop and acceptance of transformers by Employer, the transformers and their components shall be properly packed for shipment to site.

The transformers shall be shipped without oil but with the tank filled with nitrogen/inert gas and sealed under positive atmospheric pressure having dew point better than minus (-) 60°C. It will be ensured that leakage does not happen after sealing for at least 8 hrs and compliance report established as a part of record. Necessary arrangement shall be ensured

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by the contractor to take care of pressure drop of Nitrogen or dry air during transit and storage till completion of oil filling during erection. A gas pressure-checking valve with necessary pressure gauge and non return adaptor valve shall be provided for replenishing/ compensation/ recharging of lost Nitrogen/Dry air. A bank of gas cylinders with suitable reducer connection, pressure regulator with pressure gauge shall be supplied for replenishing the gas lost due to leakage.

Impact recorders shall be installed by the contractor on each transformer to record the jerks/ impacts during transit from the point of despatch upto the site. The recorders should have inbuilt battery backup upto three (03) months from the date of despatch of consignment. Acceptable limits for impacts in all directions shall be specified by the OEM of recorder. Reports of impact recorder shall be downloaded & submitted to employer just after arrival of transformer at site. Recorder(s) shall not be removed from the transformer by the contractor without permission of employer. Signature Tests" like SFRA etc. shall be carried out before dispatch from factory and after arrival at site to confirm any changes in signature and proper record shall be maintained.

The dispatch of transformer should be so planned that these are unloaded directly at their place of installation and erection is taken up immediately. The transformers shall be oil filled immediately after erection to avoid ingress of moisture in windings. If due to any unavoidable reasons transformers are required to be stored in transit before reaching to its final location, the Contractor shall take due care as prescribed by the manufacturer and shall maintain positive pressure of dry nitrogen having dew point better than minus (-) 60^0C to keep the transformer dry. In case of long storage of transformer at site, transformer shall be filled with oil after application of vacuum & checking healthiness of winding / bushing without any additional cost implication to the Employer. Storage of transformer (if required) in appropriate store preferably covered shall be the responsibility of Contractor without any extra financial implication to the Employer.

Contractor shall test for moisture measurement in solid insulation by test like tan δ, RVM etc. Test shall be done before and after heat run test at factory and during pre-commissioning. Contractor shall also perform other test as per IEC 60076/ IS2026.

The Contractor shall supply all the required tools and handling equipments like mobile crane, forklifts, trailers, trucks for loading, handling in transit areas, unloading and storage of cases and packages. If the transformer is transported from shop with oil, the above clause shall not be applicable.

8.7.2 Drying and Filling of Oil

The transformers shall be dried out under vacuum of about 1mbar for 24 hours at site after erection. The Contractor shall furnish complete details of method, tests etc. recommended for drying at site after erection.

8.8 Spare Parts

Specified/mandatory spare parts shall be supplied in accordance to clause 1.8 "Spare Parts" of "Section 1 - General Technical Requirements".

Specified spare parts to be supplied under this section at each plant location are as follows:

S.No.	Description	Quantity
1.	HV & MV Bushings complete with gaskets	1 no. for each type
2.	HV & MV Neutral Bushings complete with gaskets	1 no. for each type
3.	LV Bushings complete with gaskets	1 no. for each type
4.	LV Neutral Bushings complete with gaskets	1 no. for each type
5.	Complete set of gaskets for tank cover and fittings used for one Transformer	1 set
6.	Neutral Bushing CTs of each type in use	1 no.
7.	Temperature Indicator with contacts	
(a)	Winding	1 no. for each type
(b)	Oil	1 no. for each type
8.	Buchholz Relay Complete	1 no. for each type
9.	Oil Level Indicator with contacts (each used type)	1 no.
10.	Pressure Relief Device	1 no. for each type
11.	Set of Valves	1 Set for each type

Note: A set is defined as the total number required for one three phase Transformer.

8.9 Deleted

8.9.1 Special Tools

The Contractor shall list and supply all special tools. List of such tools including their make and detailed specification shall be submitted for acceptance by the Employer.

The proposed list of special tools must include the following in addition to tools recommended by manufacturer(s):

1. 01 Sets of full kit of tools & spanners of required sizes; All spanners shall be single ended and case hardened.

2. Bushing handling & lifting tools with nylon rope/belt including rack for holding (01 Set).

3. Hydraulic jacks for lifting the transformers, and for changing the plane of rotation of wheels (01 Set).

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4. Tirfors with wire rope and slings with grippers etc. for hauling the transformer (01 Sets)

8.9.2 Deleted

8.10 Quality Assurance and Testing

The Contractor shall follow the quality assurance and testing requirements as per approved "Quality assurance and Testing Specifications (QTS)".

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9 SOLAR PLANT TRANSFORMERS (INVERTER DUTY TRANNSFORMER) AND STATION SUPPLY TRANSFORMER/ AUXILLIARY TRANSFORMER

9.1 Scope of Work

Scope of work under this section covers the provision of labour, tools, plants, materials and performance of work necessary for the design, manufacture, quality assurance, quality control, shop assembly, shop testing, delivery at site, site storage and preservation, installation, commissioning, performance and acceptance testing, training of Employer's personnel, handing over to employer and guarantee for two years of Solar Plant Transformers and Station Supply Transformer (if applicable), Auxiliary Transformer for Solar Photovoltaic (SPV) Power Plant and as per the specifications hereunder ,complete with all auxiliaries, accessories, spare parts and warranting a trouble free safe operation of the installation.

The scope of work shall be a comprehensive functional system covering all supply and services including but not be limited to following:

9.1.1 Solar Plant Transformers

(i) Solar Plant Transformers (Inverter Duty Transformer) (SPT (IDT)) as per system requirement, complete with cubicles and all necessary accessories such as bushings, off-circuit tap changer, CTs, instrumentation, fittings etc

(ii) SPT(s) shall be compatible with offered model of grid connected PCU/ String inverters

(iii) Spare Parts in accordance to clause 9.8 "Spare Parts" of this section.

(iv) Tools and Instruments in accordance to clause 9.9 "Tools and Instruments" of this section

Any other item(s) not mentioned specifically but necessary for the satisfactory completion of scope of work defined above, as per accepted standard(s) / best international practices.

9.1.2 Station Supply Transformers (If applicable) and Auxiliary Transformer

Transformer(s) complete with cubicles and all necessary accessories such as bushings, off-circuit tap changer, CTs, instrumentation, fittings etc. The Contractor shall make detailed calculations based on the actual power consumption of the connected equipment to check the adequacy of capacity and submit these data to the Owner's approval. In case actual power consumption comes out to be more, the Contractor shall have to manufacture and supply the transformer(s) as per actual requirement.

Auxiliary Power Supply System

Auxiliary power supply arrangement shall be in line with tender Single Line

Diagram (SLD).

Main Control Room, inverter room, Local Pooling/ Sub pooling Substations etc shall have its own auxiliary power supply system comprising of AC distribution board (ACDB) which shall be fed from LV side of Inverter transformers through suitably rated auxiliary transformers. At Main Control Room, auxiliary transformer directly feed from 33kV switchgear are also acceptable.

All ACDB's of main control room shall receive at least two incomers (100 % rated) (fed from different sources) & one bus coupler with suitable changeover and interlocking arrangement. ACDB's of other locations shall be fed from one Auxiliary Transformer and Auxiliary Transformer shall be fed from IDT LV Cable box (cable box-1 & 2) with suitable change over switch. (MCCB for 400 A & below rated and ACB, if more).

Following consideration shall be taken while arriving kVA capacity of auxiliary transformer:-

1. 20% design margin
2. Actual Connected Load

All non-critical auxiliary loads like illumination, Fan supply, Module Washing System, and other non-critical auxiliary loads shall be fed from this ACDB. However auxiliary power supply for Power Conditioning Unit/ string inverters and other emergency loads (SCADA, control and protection requirement of switchgears and emergency lighting, CCTV etc. shall be taken through Suitably rated UPS/ Inverter fed from this ACDB. Size, rating, scheme/ arrangement of UPS/ inverter shall be chosen as per criteria specified elsewhere in the specification.

9.2 Specific Parameters and Layout Conditions

The Solar Power Transformers and Station Supply Transformers/ Auxiliary Transformers shall be of proven design for intended duty specified to ensure a high reliability and availability. The transformers shall be suitable and design shall be capable to withstand frequent start and stop sequence.

The power from inverters will be stepped up to 33 kV level by suitable size solar power transformers. The transformers shall be located in the vicinity of inverter rooms.

Station Supply Transformer (s) shall be connected to the 33 kV voltage outgoing panel through XLPE cable. A suitable Oil / Air bushing at HV/MV end of the transformer shall be provided. LV side shall be connected to 415 AC distribution board(s) through suitable size cables. The transformers shall be oil-immersed with ONAN cooling. All the control and instrumentation panels / devices shall be so arranged that these are easily visible and conveniently and safely accessible from the front.

Solar Power 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 connections 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 adverse effect on life of transformer due to cloud intermittency and solar generation loading cycle must be compensated through suitable design (as applicable).

The multi-winding transformer needs to be designed for long term operating conditions with asymmetrical load on LV side i.e., For three winding design, the transformer needs to operate reliable with only one inverter supplying power to only one LV winding. In case Transformer is having more than two winding, 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. In case of inverter transformer, it shall be proven and of successfully type tested design including short circuit test (as per IEC 60076 part 5).

Contacts from Solar Power transformer and Auxiliary transformer fittings/protection devices shall be wired for tripping of inverter transformer Circuit Breaker. Detailed scheme regarding same shall be finalized during detailed engineering.

In case the inverter transformer/ auxiliary transformers are placed indoors, Dry Type Transformer shall be used and their construction shall be in accordance to IS:2026, IS:11171 or equivalent to any other international standard, Indian Electricity Act 2003, BEE Guideline & CEA notifications. Transformer rating and all related technical parameters including tap changer (if applicable) shall be as per system requirement. The insulation class shall be Class F or better. Transformer shall be complete & functional in all respect. The fittings/accessories including protection/monitoring device (temperature scanner) generally required for satisfactory operation of the transformer, are to be provided.

9.3 Rating and Functional Characteristics

Sr. No.	Transformer	Solar Power Transformer (SPT)/IDT	Station Supply Transformer (SST)/ Auxiliary Transformer

1.	KVA Rating	As per system requirement	As per system requirement
2.	Quantity	As per system requirement	As per system requirement
3.	Voltage Ratio (kV)	Generated Voltage/ 33kV	33 kV (For SST) & Generated Voltage (For Aux. Tr) /0.433 kV
4.	Winding	2(Two) to 5 (Five)	Two
5.	Frequency	50 Hz	50 Hz
6.	Duty	Continuous	Continuous
7.	No. of Phases	Three	Three
8.	Vector Group & Neutral Earthing	As per system requirement	As per system requirement
9.	Cooling	ONAN	ONAN
10.	Tap Changer	OCTC, +/- 5%@2.5%step on HV	OCTC, +/-5%@2.5%step on HV
11.	Impedance at 75 degree C on Principal & Other Taps	As per IS 2026	As per IS 1180
12.	Permissible Temperature rise of Top Oil & Winding over Ambient temp of 50degC (Irrespective of tap)	As per IS 2026	As per IS 1180
13.	SC Withstand Time	2 Sec.	2 Sec
14.	Fault Level & Bushing CT	As per system requirement / SLD	As per system requirement/ SLD
15.	Termination	As per system requirement/SLD	As per system requirement/SLD
16.	Air Clearance	As per CBIP/ IS	As per CBIP/IS
17.	Bushing Rating, Insulation Class (Winding &Bushing)	As per relevant IS/ IEC (However SPT LV side winding & bushing insulation class shall be of at least 3.6 kV)	As per relevant IS/IEC
18.	Noise Level	As per NEMATR-1	As per NEMATR-1
19.	Loading Capability	Continuous operation at rated KVA on any tap with voltage variation of +/-10%, also transformer shall be capable of being loaded in accordance with IS:6600/ IEC60076-7.	

20.	Flux Density	Not to exceed 1.9 Wb/sq.m. at any tap position with +/-10% voltage variation from voltage corresponding to the tap. Transformer shall also withstand following over fluxing conditions due to combined voltage and frequency fluctuations: a) 110% for continuous rating. b) 125% for at least one minute. c) 140% for at least five seconds. Contractor shall furnish over fluxing characteristic up to 150%
21.	Foundation	All the foundation shall be designed as per highest rating Transformer in case different capacity transformer are offered.

Typical SLD is attached with the bidding document.

Cumulative capacity of solar power transformer (Inverter Duty Transformer) shall not be less than total rated kVA capacity of respective Inverters.

9.4 Performance Guarantee

The transformers along with all auxiliaries and accessories shall be capable of performing intended duties under specified conditions. The Contractor shall guarantee the reliability and performance of the individual equipment as well as of the complete system.

9.5 Design and Construction

9.5.1 Codes and Standards

The system and equipment shall be designed, built, tested and installed to the latest revisions of the following applicable standards. In the event of other standards being applicable they will be compared for specific requirement and specifically approved during detailed engineering for the purpose:

Sl.No.	Standard	Description
1.	IS:2026, IS:6600, IEC:60076	Transformers
2.	IS:2099, IEC:60137, IS 3347,IS12676	Bushings
3.	IS-335	Insulating oil
4.	IS:2705, IEC 60185	Bushing CTs
5.	IS-1180(Part 1) -2014(Revised)	Distribution Transformer
6.	Indian Electricity Act 2003, BEE Guideline 3 star or better & CEA notifications	

9.5.2 General Construction

Transformers shall be constructed in accordance to IS:2026 and IS:3639 or equivalent to any other international standard and shall be complete & functional in all respect.

The other important construction particulars shall be as below.

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. The relay shall be provided with a test cock suitable for a flexible pipe connection for checking its operation.

iii) 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.

iv) 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.

v) The transformer shall be provided with conventional single compartment conservator. The top of the conservator shall be connected to the atmosphere through a transparent type silica gel breather. Silica gel is isolated from atmosphere by an oil seal.

vi) Transformer shall have adequate capacity Conservator tank to accommodate oil preservation system and volumetric expansion of total transformer oil.

vii) Transformer shall have Oil Temperature Indicator and Winding temperature Indicator applicable for transformer above 50 KVA with accuracy class of +/-2 deg.

viii) For Transformers above 100 KVA, the radiators shall be detachable type, mounted on the tank with shut off valve at each point of connection to the tank, along with drain valve at the bottom and relief valve at the top.

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

x) Marshalling Box shall be of sheet steel, dust and vermin proof provided with proper lighting and thermostatically controlled space heaters. The degree of protection shall be IP 55 or better. Marshalling Box of all transformers shall be preferably Tank Mounted. One dummy terminal block in between each trip wire terminal shall be provided. At least 20% spare terminals shall be provided on each panel. The gasket used shall be of neoprene rubber. Also Marshalling Box, shall be at least 450 mm above

ground level (for transformer above 100 KVA). For transformer above 100 KVA, wiring scheme (TB details) shall be engraved in a stainless steel plate with viewable font size and the same shall be fixed inside the Marshalling Box door.

9.5.3 Windings

i) The conductors shall be of electrolytic grade Copper/ Aluminium free from scales & burrs.

ii) All windings of the transformers shall have uniform insulation.

iii) Tapping shall be so arranged as to preserve the magnetic balance of the transformer at all voltage ratio.

iv) The transformer shall be oil insulated type (As applicable)

9.5.4 Core

i) The core shall be constructed from non-ageing, cold rolled, super grain oriented silicon steel laminations equivalent to M4 grade steels or better.

ii) Core isolation level shall be 2 kV (r.m.s) for 1 minute in air.

iii) Adequate lifting lugs will be provided to enable the core & windings to be lifted.

9.5.5 Fittings

The following fittings shall be provided with transformer:-

i) Conservator for main tank (transformer above 100 kVA 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 around level) etc.

ii) Buchholz relay, double float type with alarm and trip contacts, along with suitable gas collecting arrangement (Gas collecting arrangement applicable for transformer above 100 KVA)

iii) Solar Power 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 below 500 kVA, diaphragm type explosion vent shall be provided.

iv) Air release plug, Bushing with metal parts and gaskets, termination connection on bushings (as applicable).

v) Inspection openings and covers.

vi) Cover lifting eyes, transformer lifting lugs, jacking pad (Jacking pad applicable for transformer above 100 KVA), towing holes and core and winding lifting lugs, inspection cover, Bilingual R&D Plate, Terminal marking plates, two nos. earthing terminals etc.

vii) Protected type Mercury or alcohol in glass thermometer.

viii) Rating and diagram plates on transformers and auxiliary apparatus.

ix) Prismatic/toughened glass oil gauge for transformers and Tap Changer chamber.

x) OTI & WTI shall be 150 mm dial type with alarm (WTI only for transformer above 50 kVA) 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.

xi) Flanged bi-directional wheels/ skids, Marshalling Box, OCTC, Bushing CTs (As applicable).

xii) For transformer above 100 KVA: Top & bottom filter valves with threaded male adapters, bottom sampling valve, drain valve/sludge removal valve at the bottom most point of the tank. For Transformer up to 100 KVA: Common drain cum sampling cum bottom filter cum sludge removal valve and top filter valve can be provided.

xiii) Terminal Marking Plates.

xiv) Valves Schedule Plates.

xv) Bolts &Nuts (exposed to atmosphere) shall be Galvanized Steel/SS.

xvi) Equipment Earthing.

xvii) Rain Hoods to be provided on Buchholz, MOG & PRD. Entry points of wires shall be suitably sealed

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

9.6 Drawings, Documents and Design Calculations

9.6.1 Design Memorandum

The Contractor shall submit to Employer a design memorandum prepared in accordance to clause 1.6 “Record and Documentation” of “Section 1- General Technical Requirements.”

9.6.2 Drawings and Documents

The Contractor shall submit all the drawings and documents in accordance with requirements stipulated in “Section 2 - Technical Documents” of “General Technical Specification (GTS)”.

9.6.3 Design Calculation

The Contractor shall submit the design calculation in accordance to Clause 2.4 of "General Technical Specification (GTS)" covering at least the following, for review / acceptance.

(i) Load calculation of transformers (in case of higher than specified, the same shall be provided),

(ii) Burden on CTs,

(iii) Temperature rise calculation of transformers,

(iv) Thermal ability to withstand short circuit

9.7 Delivery, Installation and Commissioning

The Contractor shall follow the requirements of Delivery, Installation and commissioning elaborated in clause 1.7 "Delivery, Installation and commissioning" of "Section 1 - General Technical Requirements."

9.8 Spare Parts

In accordance to clause 1.8 "Spare Parts" of "Section 1 - General Technical Requirements". Specified spare parts to be supplied under this section at each plant location are as follows:

S. No.	Description	Quantity
1.	Solar Power Transformer (IDT) complete with fittings	01no (Higher Rating)
2.	Set of valve for Solar Power Transformer (IDT)	01 Set for each type
3.	MV and LV Terminal Bushing with metal parts and gasket for SPT (IDT)	01 no each type
4.	Pressure Relief Device for SPT	01 no. for each type
5.	Magnetic Oil Gauge for SPT	01 no. for each type
6	MV and LV Terminal Bushing with metal parts and gasket for SST (If applicable)	01 no each type
7	Auxiliary Transformer (Inverter Output Voltage /433 V) & SST (33/.433kV) complete with fittings	01 no (Higher Rating)
8	WTI and OTI with contacts for a. SPT b. SST(If applicable) & Aux Transformer	1 no each type 1 no. each type

9	Buchholz relay complete for a. SPT b. SST (If applicable) & Aux Transformer	01 no each type 01 no each type
10	Winding Temperature Protection relay for SPT (MV & LV)	01 no each type
11	Winding Temperature Protection relay for SST (MV & LV) (If applicable) & Auxiliary Transformer	01 no each type

9.9 Tools and Instruments

The Contractor shall supply all necessary tools and instruments etc. for installation, repair and maintenance in accordance to clause 1.9 “Tools and Instruments” of “Section 1 - General Technical Requirements”

S.No.	Description	Quantity
1	Tool Box	01 no

9.10 Quality Assurance and Testing

The Contractor shall follow the quality assurance and testing requirements as per approved “Quality assurance and Testing Specifications (QTS)”.

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10 DC SYSTEM

10.1 Scope of Work

Scope of work under this section covers the provision of labour, tools, plants, materials and performance of work necessary for the design, manufacture, quality assurance, quality control, shop assembly, shop testing, delivery at site, site storage and preservation, installation, commissioning, performance and acceptance testing, training of Employer's personnel, handing over to Employer and guarantee for two years of DC system for Solar Photovoltaic (SPV) Power Plant and as per the specifications hereunder, complete with all auxiliaries, accessories, spare parts and warranting a trouble free safe operation of the installation.

The scope of work shall be a comprehensive functional system covering all supply and services including but not be limited to following:

10.1.1 DC System

DC System at Solar PV project shall be of following type:-

a. DC Supply shall be used for control and protection system of switchgear.

   220 V DC or 110 V DC System shall be provided for Main Control Room area

   In Main Control Room area each UPSDB shall have two incomers fed from two separate UPS and one bus coupler. Similarly, each DCDB / DC switchgear shall have two incomers fed from two separate Battery-Charger and one bus-coupler.

b. For rest of the areas such as inverter room/ location etc, the DC power supplies may be provided as per the following :-

   Battery size shall be for min load of 2 kW (DC) with 01 hour backup.

   All these areas shall be equipped with two nos UPS (2x 100 % capacity Minimum) comprises of UPS DB, static and manual bypass switch, necessary protective devices, accessories alongwith common battery bank for providing 01 hour (Min) backup. Each UPS shall consist of 1x100% charger and inverter and its rating shall be 2 KVA (min). In case, load requirement is more, higher size UPS shall be provided. UPS & SCADA PLC/RTU panels shall be placed indoors.

   All UPS having rating 5 kVA or more shall have three phases input. The UPS shall have an overload capacity of 125 % rated capacity for 10 minutes and 150 % rated capacity for 10 seconds. The overall efficiency of UPS shall be at least 80% on full load. For UPS capacity 5 kVA or more in addition to indications/display on UPS panel, important alarms along with relevant analog measurements shall also be provided by employing RS 485 Port MODBUS Protocol/ Ethernet TCP/IP protocol for use in SCADA. The list of alarm output & analog signals shall be as approved during detailed engineering. For UPS capacity less than 5 kVA, contractor shall provide status, common

alarm and trip DI (soft or hard) signal to SCADA. Contractor shall submit configuration diagram, single line diagram and data sheets etc. which will be finalized during detailed engineering. In place of UPS, bidder can provide DC supply system (2 x 100% Battery with Charger system) if the auxiliary power supply requirement of the loads are in DC.

DC Supply shall be used for control and protection system of switchgear. In case UPS AC supply is considered for auxiliary control and protection supply for switchgear (except areas mention in point (a) above), then suitably rated AC/DC converter/power pack with required backup shall be used to meet the DC control supply requirement of switchgear panels.

c. Size, rating etc of Power Pack, UPS, Battery Charger and Battery shall be finalized during details engineering stage. Following shall be considered for sizing calculation;

- UPS load power factor shall be taken as 0.8 lagging.
- UPS efficiency shall be taken as 80%.
- UPS and charger design margin shall be taken 10% at 50 deg C.
- For Battery sizing calculation, lowest electrolyte temperature shall be taken as 5 deg C more than the minimum ambient temperature or 15 deg cel whichever is lower, with Temperature correction factors as per relevant standards.
- Batteries aging factor shall be taken as 1.25 and design margin factor shall be taken as 1.10.

d. The cabinets shall be IP- 42 protection class for indoor application and IP65 for outdoor application. The temperature rise inside all the cabinets/enclosures shall not exceed 10deg.C above ambient temperature. One set of tool shall be provided for maintenance and testing purposes.

e. DC System comprises of following equipments /component (as applicable);-

i) 220V DC or 110V DC VRLA battery banks complete with terminal connections, hardware, connecting cables and associated accessories as per the system requirement,

ii) 220V DC or 110V DC battery chargers as per the system requirement

iii) 220V DC or 110V DC distribution boards as per the system requirement.

iv) Suitable capacity UPS along with Battery Banks, charger, distribution boards etc. Each equipment shall be complete with terminal connections, hardware, connecting cables and associated accessories as per system requirement.

v) Seismic-proof racks, hardware, interconnecting cables and other accessories etc for each bank of batteries,

vi) Coordination and Provision of necessary contacts and/or ports for integration with plant SCADA system

vii) Spare parts in accordance to clause 10.8 “Spare Parts” of this section

viii) Tools and instruments in accordance to clause 10.9 “Tools and Instruments” of this section

Any other item(s) not mentioned specifically but necessary for the satisfactory completion of scope of work defined above, as per accepted standard(s) / best international practices.

10.2 Specific Parameters and Layout Conditions

10.2.1 Layout and General Arrangement

Each set of battery bank of 220V DC or 110V DC shall be capable of supplying successfully total loads of 220V or 110V DC systems respectively for at least two (02) hours without any assistance from the charger and without its terminal voltage falling below 203.5 V/101.75V in case of 220V/110 V battery.

The 220V DC or 110V DC system in the plant shall have provision for boost and float charging and distribution boards. The AC power supply for 220V DC or 110V DC battery chargers shall be taken from 415V boards and the chargers shall be so designed that they can give full float and boost charging currents within the given voltage variation.

220V DC or 110 V DC systems shall be capable to supply following auxiliary load in addition to its main function / duty:

i) All the control and protection circuits

ii) Motors for CB spring charging mechanism

iii) Inverters for Control & protection circuit, emergency lighting in Control room, Control Desk etc. of Plant

iv) Any other Location / duties

The Contractor shall make detailed calculations based on the actual power consumption of the connected equipment and submit these data to the Engineer In Charge for approval.

A) Design Considerations

The basic description of scheme for DC system shall be as per system requirement. The DC supply shall be made available to switchyard area and other areas. The scheme for these areas shall be finalised during detailed engineering.

The battery will furnish practically all the heavy current demands required for operating contingencies such as failure of AC supply or when charger is under maintenance etc.

Suitable interlock operation shall be provided between float charger and boost charger, float charger output circuit breaker and bus tiebreaker, incoming breakers of DCDB and boost chargers.

Normally, both inverters/ UPS at their reduced rating shall share the total inverter/UPS load equally. However, in case of failure of any of the inverters/UPS, other shall be capable to supply total AC load connected to inverter/UPS system.

B) 220V DC or 110V DC System:

In case of 220V DC or 110V DC system, two identical chargers each complete with float charging and boost charging functions etc. are required. Normally, each of the two float chargers shall supply one half of the total DC load and also be supplying the trickle charging current for one battery bank. In case of failure of any of the float chargers, the other should be able to supply the complete DC load and trickle charging current to all the battery banks.

Each boost charger shall be used for charging one battery bank speedily. During boost charging, the load would be continued to be met by float charger.

In case of main AC failure during boost charging, the load shall be supplied instantaneously by the battery through the tap cell and subsequently the total battery shall be connected to the load through the DC contactor.

If float charger fails during boost charging, the boost charging is continued by boost charger and the load is supplied through the respective tap cell.

Provision shall be made so that each of the boost chargers can be selected to charge any one of the battery banks at a time.

10.3 Rating and Functional Characteristics

10.3.1 Rating

The capacities of the batteries and inverters given in this specification are estimated minimum values. The Contractor shall make detailed calculations based on the actual power consumption of the connected equipment and supply the system according to the actual requirement. In case actual power consumption comes out to be lesser, the Contractor shall supply the equipment as per the minimum capacities mentioned in the specification.

10.3.1.1 Battery Chargers

1.	AC Power Supply	415 ± 10 %V, 3-phase, 4 wire
2.	Frequency	50 ± 5% Hz
3.	Nominal DC Output Voltage	220V or 110 V adjustable
4.	Voltage Regulation (From No load to Full load)	±1 %
5.	Ripple of Output Voltage (Peak to Peak)	

	With Battery Connected Without Battery Connected	< 1 % RMS < 1 % RMS

10.3.1.2 Batteries

	220 V/ 110 V DC Battery Bank	VRLA type
1.	No. of Battery Bank	2
2.	No. of cells in Each Battery Bank	110/55
3.	Nominal Cell Voltage	2 V
4.	Cell Voltage at Equalizing Charge	2.33 V
5.	Nominal End Cell Voltage	1.85 V at 10 hour rate (C10)
6.	Minimum Ampere-Hour capacity of each Battery Bank (min 2 hr backup)	As per system requirement

10.3.1.3 Inverters

1.	Rated Capacity	As per system requirement
2.	Rated Input Voltage (DC)	220 V/110 V (plus (+) 10%/ minus (-) 20% DC)
3.	Rated Output Voltage (AC)	As per system requirement
4.	Rated Frequency	50Hz
5.	Voltage Regulation	± 2 %
6.	Frequency	50 ± 0.5 % Hz
7.	Wave form	Sine, with max. 5 % THD at linear load Sine, with max. 7 % THD at 100% non-linear load
8.	Overload Capacity for 100 ms	2 times Rated Current
9.	Overload Capacity for 1 min	1.5 times Rated Current

10.4 Performance Guarantee

The DC system along with all auxiliaries and accessories shall be capable of performing intended duties under specified conditions. The Contractor shall guarantee the reliability and performance of the individual equipment as well as of the complete system.

10.5 Design and Construction

10.5.1 Standards

The system and equipment shall be designed, built, tested and installed to the latest revisions of the following applicable standards. In the event of other standards being applicable they will be compared for specific requirement and specifically approved during detailed engineering for the purpose:

S.No.	Standards	Description
1.	IEEE Std 485	IEEE recommended practice for sizing VRLA batteries for stationary applications.
2.	IEC 60146	Semiconductor converters.
3.	IEC 60439	Low-voltage switchgear and control assemblies.

10.5.2 Batteries and Battery Racks

The individual VRLA type Battery cells shall have removable top cover and a float to showing the electrolyte level in the battery. The polarity of the batteries shall be engraved and shall be easily legible.

Each battery assembly shall be complete with racks, flexible connections between the cells and a cable terminal box containing the battery dc MCCB (2 poles). Inter cell connectors shall be insulated type. Adequate alarm devices (with auxiliary contacts for remote indication) shall be provided with the battery DC MCCB in order to indicate the tripping of this MCCB.

The battery racks shall be designed to withstand earthquake forces as laid down in “Section 1 - General Technical Requirements” without damage to the batteries. The batteries shall preferably be arranged in not more than two levels. The connecting points of the cells shall be easily accessible for the periodic checks of the cell voltage.

10.5.3 Battery Chargers

Dry type transformers and static type rectifiers shall be used throughout. The battery charger cubicle shall be provided into separate compartments for each of the twin battery chargers and the respective main circuit breakers. The charger cubicles shall be provided with a protection class of at least IP 42.

The chargers will be protected against harmful overload by a drooping characteristic, which transfers all loads in excess of the capacity of the chargers to the battery. The battery chargers shall be connected in parallel with the corresponding battery through the main distribution bus bar.

The chargers shall be completely equipped for a fully automatic and controlled charging and floating charge of the batteries, and shall be of the constant voltage type with current limiting devices.

Complete control and supervision equipments such as circuit breakers, ammeters, voltmeters, earth leakage meters and alarm indicating devices shall be incorporated with each charger.

At least following alarm devices shall be provided for alarm/indication on the charger.

i) AC Mains Fail

ii) Charger Failure

iii) AC & DC Over voltage

iv) AC & DC Under voltage

v) DC Ground Fault

vi) Charger overload

Necessary alarm/potential free contacts shall be provided for remote indication and alarm at SCADA level in accordance to clause no. 10.5.6.

The battery charger shall have provision for automatic temperature compensation of charging current. The equipment shall have provisions for testing the ground resistance alarm device on both poles (plus and minus).

The Charger shall be fabricated using cold rolled sheet steel shall not less than 1.6 mm and shall have folded type of construction. The panel frame shall be fabricated using cold rolled sheet steel of thickness not less than 2.0 mm. Removable undrilled gland plates of at least 3.0 mm sheet steel and lugs for all cables shall be supplied by the Contractor. The lugs for cables shall be made of electrolytic copper with tin coat.

The arrangement of Charger components shall be such that their heat losses do not give rise to excessive temperature within the Charger panel surface. Location of the electronic modules will be such that temperature rise of the location, in no case, will exceed 10°C over ambient air temperature outside the Charger.

Each Charger panel shall be provided with an illuminating lamp and one 5 Amp. Socket. Switches and fuses shall be provided separately for each of the above. Locking facilities shall be provided as following:

The Charger enclosure door locking requirements shall be met by the application of padlocks. Padlocking arrangement shall allow ready insertion of the padlock shackle but shall not permit excessive movement of the locked parts with the padlock in position.

10.5.4 DCDB Cubicles

DCDB cubicles shall be of free floor-standing type and of manufacturer's standard production with protection class at least IP 42. Each cubicle shall be divided into sections or compartments, for housing the respective equipment. The circuit breakers for the outgoing feeders in the main distributions shall be housed in one compartment. Also, separate vertical cable compartment shall be provided.

10.5.5 DC Distribution Boards

The distribution board shall consist of sectionalised bus with tie breaker and each section of bus shall have one incoming disconnecting MCCB, sufficient nos. of outgoing MCCBs of suitable capacity, as per Single Line Diagram and system requirement, automatically controlled heating element and all necessary control, protection and supervision instruments. Each board shall have at least 20% installed spare feeders with minimum one of each type in use.

10.5.6 Alarm and Indication

Necessary provision/potential free contacts shall be made available for alarm and indication of at least following group faults:

i) Battery Faults

ii) Battery Fuse Blown

iii) Float Charger Fault

iv) Boost Charger Fault

v) Battery MCCB Status (Closed/Open/Trip)

vi) DCDB incoming MCCB Status (Closed/Open/Trip)

vii) Inverter MCCB Status (Closed/Open/Trip)

10.5.7 Inverters

Static inverters of on-line type shall be installed nearby to the 220V DC or 110 V DC main distribution board and be suitable to feed continuously the essential loads. The static inverter will be connected to the 220V DC or 110 V DC system and a distribution board. The inverter will serve essential consumers of the control system, emergency lighting in control room, power outlets circuits of control room, office areas and individual sockets intended for electronic appliances and computers, monitors, printers etc.

The inverter panel shall include:

i) Electronic switches and all accessories for uninterrupted power supply

ii) Instruments for Input/output voltage, current and frequency

iii) Alarms on the panel front

10.6 Drawings, Documents and Design Calculations

10.6.1 Design Memorandum

The Contractor shall submit to Employer a design memorandum prepared in accordance to clause 1.6 “Record and Documentation” of “Section 1-General Technical Requirements.”

10.6.2 Drawings and Documents

The Contractor shall submit all the drawings and documents in accordance with requirements stipulated in "Section 2 - Technical Documents" of "General Technical Specification (GTS)".

10.6.3 Design Calculation

The Contractor shall submit the design calculation in accordance to Clause 2.4 of "General Technical Specification (GTS)" covering at least the following, for review / acceptance.

i) Calculations of the DC power consumption during standstill of the plant, during start, operation and shut-down of plant, taking into consideration that the floating charge voltage of cell is maintained,

ii) Calculations for capacity of the batteries,

iii) Calculations for ratings/ capacities of the battery chargers, UPS

iv) Calculations for capacity of the inverters

10.7 Delivery, Installation and Commissioning

The Contractor shall follow the requirements of Delivery, Installation and commissioning elaborated in clause 1.7 "Delivery, Installation and commissioning" of "Section 1 - General Technical Requirements."

10.8 Spare Parts

Specified/Mandatory spare parts shall be supplied in accordance to clause 1.8 "Spare Parts" of "Section 1 - General Technical Requirements". Specified spare parts to be supplied under this section are as follows:

S.No.	Description	Quantity
(A) Battery		**220V/ 110 V (As Applicable)**
1.	Battery Cells	5 Nos.
2.	Vent Plugs of each type Caps of each type Connecting Bolts/ Connectors of each type used	5 Nos. each 5 Nos. each 5 Nos. each
3.	Inter Cell Connectors	5 Nos.
(B) Distribution Boards		**220V DC/ 110 V DC (As applicable)**
1.	Contactor of each type used	1No. each
2.	Relay of each type used	1 No. each
3.	Indicating Instruments of each	1 No. each

	type used	
4.	Circuit Breaker of each type used	1 No. each
(C) Battery Charger		**220V DC/ 110 V DC (As applicable)**
1.	Indicating Instruments of each type used	1 No. each
2	Complete Thyristor Bridge/ Module of each type used	1 No. each
(D) Inverter		
1.	Circuit Breaker of each type used	1 No. each
2.	Complete Thyristor Bridge/ Module of each type used	1 No.
(E)	Spare Battery bank for inverter station/sub pooling system UPS/charger with mounting rack (To be kept in MCR battery room)	1 Set
(F)	UPS	01 No of each type & rating

10.9 Tools and Instruments

The Contractor shall supply all necessary tools and instruments etc. for installation, repair and maintenance in accordance to clause 1.9 “Tools and Instruments” of “Section 1 - General Technical Requirements”.

The list of special tools must include the following

i) Six (6) numbers Hydrometer (If applicable),

ii) Two (2) numbers Cell Testing Voltmeter

10.9.1 Deleted

10.10 Quality Assurance and Testing

The Contractor shall follow the quality assurance and testing requirements as per approved “Quality assurance and Testing Specifications (QTS)”.

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11 CONTROL AND MONITORING (SCADA) SYSTEM

11.1 Scope of Work

Scope of work under this section covers the provision of labour, tools, plants, materials and performance of work necessary for the design, manufacture, quality assurance, shop assembly, shop testing, delivery at site, site storage and preservation, installation, commissioning, performance and acceptance testing, training of employer's personnel, handing over to employer and guarantee for two years of control and monitoring system for Solar Photovoltaic (SPV) Power Plant and as per the specifications hereunder, complete with all auxiliaries, accessories, spare parts and warranting a trouble free safe operation of the installation.

The scope of work shall be a comprehensive functional system complete in every respect including but not be limited to following:

11.1.1 Control and Monitoring System

The plant shall be automatically monitored by data acquisition system. There shall be data logging recording and display system for continuous monitoring of data for different parameters of different sub systems of the power plant.

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.

Bidder shall include in his proposal 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.

The complete Solar PV plant shall be integrated with SCADA which should also communicate with all the inverters, HT Breakers and other equipments as per the details mentioned in specification. SCADA shall also have provision to control turning ON and OFF of any inverter of the grid connected Solar PV plant.

SCADA shall provide instantaneous data, status & control (wherever applicable) for following.

1. 33kV Switchgear Equipment
2. Station Supply Transformers (if applicable)
3. Auxiliary Transformer
4. LV Switchboards
5. Solar Power Transformers (SPT)(Inverter Duty Transformer(IDT))
6. Control & Monitoring of Switchyard & its equipment
7. DC Systems
8. Data transfer to remote ends as per Transmission Utility/CEA/LDC/GSECL etc requirement & Grid Connectivity Regulation (Necessary hardware, software, modem, RTU etc. to be supplied as per system requirement).

9. All other auxiliary systems i.e. fire alarm/fighting/ weather monitoring etc.
10. Each Inverter parameters
11. Monitoring of DC input from SCB (As per Chapter 4 i.e. Power Conditioning Unit)
12. Numerical Relay
13. MFM/TEM/ABT meter
14. Continuously measure ambient temperature, wind speed and solar irradiation/insolation & other weather parameters and simultaneously measure the generation of DC Power as well as AC Power generated from the plant.
15. Performance Monitoring and Diagnostic Functions
16. 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
17. Any other parameter considered necessary based on current prudent practice.
18. Necessary coordination with supplier of transmission line bay equipments and its integration (wiring, RTU etc) in SCADA is also in the scope of supply.
19. Spare parts in accordance to clause 11.8 “Spare Parts” of this section.
20. Tools and instruments in accordance to clause 11.9 “Tools and Instruments” of this section

An integrated data acquisition system shall be supplied which should be capable of communicating with all inverters and provide information of the entire Solar PV Grid interactive power plant.

Power plant controller (PPC) shall be provided with two processors (main processing unit and memories), one for normal operation and one as hot standby. In case of failure of working PPC processor, there shall be an appropriate alarm and simultaneously the hot standby PPC processor shall take over the plant control function automatically. The transfer from main processor to standby processor shall be totally bump less and shall not cause any plant disturbance whatsoever. It shall be possible to keep any of the PPC processors as master and other as standby. The standby processor shall be updated in line with the changes made in working processor. The solar plant SCADA and PPC networks shall be suitably designed, so that PPC shall directly and independently able to control the individual solar inverter. Detailed control logic in the PPC shall be finalized during detailed engineering stage.

SCADA shall store the daily energy, monthly energy and the annual energy produced by the plant.

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 shall display of status of major equipment in Single Line Diagram (SLD) format.

SCADA should also have provision for offline viewing of daily, monthly and annual average of the above parameters with storage for historical trending and analysis.

SCADA shall provide 15 minute interval daily, monthly and annual average of following parameters:

1. Exported energy

2. Energy of each inverter

The SCADA shall have the feature to be integrated with the network system as well as remotely (corporate office/Site Office/ other location as per requirement) via the web using either a standard modem or a GSM/WIFI modem or through dedicated leased line. The contractor shall provide compatible software and hardware so that data can be transmitted via standard modem. Internet connection for transferring data to web shall be taken by Contractor in the name of employer for O & M period (Contractor shall bear the establishment charges as well as recurring monthly/ annual rental charges for contractual O&M period).

Computer Aided Data Acquisition Unit in the form of personal computer (PC) Supporting with competent internal hardware and software shall be a separate and individual system comprising of different transducers to read the different variable parameters, A/D converter, Multiplexer, De multiplexer, 16 Interfacing hardware & software, industrial type PC, which will be robust & rugged suitable to operate in the control room environment. Reliable sensors for Solar Radiation, Temperature & other electrical parameters are to be supplied with the data logger unit.

The SCADA shall be OPC version 2.05a compliant (or latest version) and implement a OPC-DA 2.05a server as per the specification of OPC Foundation. All data should be accessible through this OPC server.

Programming of the PLC Processor/controller as well as programming of HMIS shall be user friendly with graphical user interface and shall not require knowledge of any specialized language. For example, the programming of PLC shall use either of the following:

- Flow-chart or block logic representing the instructions graphically

- Ladder diagrams

The programming of HMIS (like development and modification of data base, mimics, logs / reports, HSR functionalities etc.) shall also be possible through user-friendly menus etc. All programming functionalities shall be password protected to avoid unauthorized modification

The control system shall be designed such that under worst case loading conditions the response time shall not be worse than the following:-

On/Off Command	The response time for screen update after the execution of the control command from the time the command is issued shall be one second (excluding the drive actuation time).
Adjustment Command	0.5 to 1 second.
On screen Updating	1 second

All Control related displays	1 second.
Bar Chart displays,	1 to 2 seconds
Plant Mimic displays	1 to 2 seconds
Group review displays	1 to 2 seconds.
X-T Plot Displays	1 to 2 seconds.
Plant Summary Displays	1 to 2 seconds.

All the Analog data shall be scanned at the resolution of 1(one) second and refreshed on screen however, recording of data shall be as finalised during detail engineering.

SCADA system shall have two inverter/UPS input power supply having min 02 hour backup to cater to outage of grid and one raw power supply.

Further the model offered should be in operational condition in India.

11.2 Specific Parameters and Layout Conditions

11.2.1 Layout and General Arrangement

The overall control shall be affected from the Central Control Room. Provision shall be made to adopt the control system for future remote monitoring from a Remote Control Centre.

The control system should be built in such a way that in case of a fault in any single equipment others are not affected and system continues to function effectively.

The control system shall be designed on open standards based on IEC 60870-5 series and Object Linking and Embedding for process control (OPC) standards. Control & Monitoring System design should be robust to address the high humidity, high temperature variations and importance should be given while selecting the field instrumentations.

11.2.2 PLC Processor & I/O Modules

The processor unit shall be capable of executing the following functions:-

a) Receiving binary and analog signals from the field and providing command output to MCC/Switchgear/ Drive etc. through Input / Output modules and operator initiated commands from Human Machine Interface System / control panel.

b) Implementing all logic functions for control, protection and annunciation of the equipment and systems.

c) Providing supervisory information for alarm, various types of displays, status information, trending, historical storage of data etc.

d) Performing self-monitoring and diagnostic functions

PLC unit shall be provided with two processors (Main processing unit and memories) one for normal operation and one as hot standby. The transfer from main processor to standby processor shall be totally bump less and

shall not cause any plant disturbance whatsoever. In the event of both processors failing, the system shall revert to fail safe mode.

The memory shall be field expandable. The memory capacity shall be sufficient for the complete system operation and have capability for at least 20 % expansion in future. Programmed operating sequences and criteria shall be stored in non-volatile semiconductor memories like EPROM. All dynamic memories shall be provided with buffer battery backup for at least 360 hours. The batteries shall be lithium or Ni-Cd type.

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

- The I/O module shall have the following features:
- Power supply monitoring
- Count bounce filtering
- Optical isolation between input and output signals with the internal circuits
- In case of power supply failure or hardware fault, the critical outputs shall be automatically switched to the fail safe mode. The fail safe mode shall be finalized during detail engineering.

20 % spare channels in input/output module fully wire up to Cabinet TB.

11.2.3 Networking and Communications

All the optical fibre cabling within the power plant shall be armoured type suitable for laying directly on the cable trays. All redundant cables shall be physically routed along different paths so as to ensure higher availabilities. The networks shall be designed for 100Mbps (Min), real time and full duplex (bi-directional) communications. All networking cables and switches shall be industrial grade.

All networks shall be configured to form a ring bus topology. The switches will detect and, without manual intervention, provide alternate paths in the event of loss of communication.

11.2.3.1 Network Security

The network equipments shall have a high level of security features in order to prevent any kind of external intrusion/hacking event into the system. The security parameter shall include port security, both Multiple IP and Multiple MAC addresses, blocking of unused port, disabling/enabling of Web manager and Telnet, Multilevel user password to secure the switch and alarming or warning system in case of fault in the network. The Industrial Control System grade Next Generation IPS Firewall shall be provided for outside access.

11.2.4 Redundancy

The control system shall have both physical and functional or operational redundancies.

All the control system should have suitable rating of surge protection device at functional level. These arresters should be pluggable type and should have fault indication.

At least the following physical redundancies shall be ensured in the design of the control and monitoring system:

i) Redundancy of communication media shall be through redundant optical fiber cables/CAT 6 UTP,

ii) Operator Station redundancy shall be ensured by mirror images of process data on all the two operator workstations,

iii) Networking redundancy shall be implemented by using redundancy of servers, routers and switches.

iv) All Controllers and their power supply distribution cards used in RTUs be redundant,

11.3 Rating and Functional Characteristics

11.3.1 Computers and Peripherals

All monitors shall be of Full HD resolution, flicker free LED backlit type with at least 22" screen size. All keyboards / functional keyboards / keypads to be supplied except those in offices and on Power Plant LAN shall be membrane protected. All Computers, printers and other accessories supplied shall be of robust and tropicalized type of construction so as to withstand solar plant environmental conditions.

11.3.2 Software Licences/ Documentation

The Contractor shall provide software license for all software being used in Contractor's System. The software licenses shall be provided for the project (e.g. organization or site license) and shall not be hardware/machine-specific. That is, if any hardware/machine is upgraded or changed, the same license shall hold good and it shall not be necessary for Employer to seek a new license/renew license due to up gradation/change of hardware/machine in Contractor's System at site.

Contractor shall also provide Minimum 2 Nos of licenses (should be IP based not through desktop sharing app like team viewer/any desk etc) for remote monitoring (Concurrent viewing of data at 2 different locations authorized with user ID/Password) of the essential parameters of the solar plant on the web using popular web browser without requirement of additional software. User ID and password for remote view can only be changed by SCADA Administrator.

The SCADA should have provision for interfacing with the central generation monitoring SCADA system at Employer corporate office. The details regarding the protocol/interface will be shared during detailed engineering.

All licenses shall be valid for the continuous service life of the plant. All the hardware and software shall be licensed to employer.

All technical manuals, reference manuals, user's guide etc., in English required for modification/editing/addition/deletion of features in the software of the PLC System shall be furnished. The Contractor shall furnish a comprehensive list of all system/application software

documentation after system organization for Employer's review and approval.

All The software listings for application software, Project data files etc. shall be submitted by the Contractor. All the SCADA Software with license Key shall be handed over to employer on the DVD/CD media. All the hardware and software shall be licensed to Employer.

11.3.3 Power Supply for RTUs/ Data Collector Unit

Power supply for RTUs/ Data collector unit shall be from reliable sources. DC. Each shall be fed from two independent power supplies for control function. One power supply shall be main and other standby. In case of failure of main supply, standby supply shall be switched on automatically.

11.3.4 Metering

Energy Meters of 0.2s accuracy class, bidirectional suitable for ABT requirement along with wiring from CT &PT shall be provided conforming to Transmission utility norms and CEA regulation on installation and operation of meters (The quantity & location shall be finalized during detailed engineering).

For measurement of Auxiliary power consumption, MFM in each ACDB incomer shall be provided by the bidder. MFM shall have suitable communication port for integration with SCADA system.

Meter shall be suitable for interfacing for synchronizing the built-in clock of the meter by GPS time synchronization equipment. Bidder shall synchronize the meter using GPS time synchronization equipment. All the hardware required for synchronization shall be in scope of bidder.

The ABT meters supplied under this contract shall also meet the requirement of respective RLDC/ State power Utilities/ CTU/STU/GSECL.

This metering system shall have following features:

a) Meters shall be microprocessor-based MWH meters having an accuracy class of 0.2S or better. MVARH meters shall have accuracy class of 0.5 or better.

b) These meters shall have provision for downloading of data through an optical port and /or through RS 232/485 port.

c) Even under absence of VT input, energy meter display shall be available and it shall be possible to download data from the energy meters.

Technical Requirements of Energy Meters for ABT Requirement

Contractor shall supply energy meters along with metering station, MRI or laptop (as applicable) as per the technical specification given below:

a) Shall be microprocessor-based conforming to IEC 62052-11, IEC 62053-22, IS 14697.

b) Shall carry out measurement of active energy (both import and export) and reactive energy (both import and export) by 3-phase, 4 wire principle suitable for balanced/ unbalanced 3 phase load.

c) Shall have an accuracy of energy measurement of at least Class 0.2S for active energy and at least Class 0.5 for reactive energy.

d) The active and reactive energy shall be directly computed in CT & VT primary ratings.

e) The reactive energy shall be recorded for each metering interval in four different registers as MVARh (lag) when active export, MVARh (Lag) when active import, MVARh (lead) when active export, MVARh (Lead) when active import.

f) Two separate registers shall be provided to record MVARH when system voltage is >97%.and when system voltage is <103%.

g) Shall compute the net MWh and MVARh during each successive 15-minute block metering interval along with a plus/minus sign, instantaneous MWh, instantaneous MVARh, average frequency of each 15 minutes, net active energy at midnight, net reactive energy for voltage low and high conditions at each midnight.

h) Each energy meter shall have a display unit. It shall display the net MWh and MVARh with a plus/minus sign and average frequency during the previous metering interval; peak MWh demand since the last demand reset; accumulated total (instantaneous) MWh and MVARh with a plus/minus sign, date and time; and instantaneous current and voltage on each phases.

i) All the registers shall be stored in a non-volatile memory. Meter registers for each metering interval, as well as accumulated totals, shall be downloadable. All the net active/reactive energy values displayed or stored shall be with a plus /minus sign for export/import.

j) At least the following data shall be stored before being over-written for the following parameters.

S.No.	Parameter	Details	Minimum No. of Days
1	Net MWH	15 min block	40days in meter
2	Aver Freq	15 min block	40days in meter
3	Net MVARH for V > 103%	15 min block	40days in meter
4	Net MVARH for V < 97%	15 min block	40days in meter
5	Cumulative Net MWH at every midnight		10 days in meter/40 days in PC
6	Cumulative Net MVARH for V> 103% at every midnight		10 days in Meter/ 40 days in PC
7	Cumulative Net MVARH for V < 97% At every midnight		10 days in Meter/ 40 days in PC
8	Date and time blocks of VT failure on any phase.		

k) Shall have a built in clock and calendar with an accuracy of less than 15 seconds per month drift without assistance of external time synchronizing pulse.

l) Date/time shall be displayed on demand. The clock shall be synchronized by GPS time synchronization equipment being supplied by the contractor.

m) The voltage monitoring of shall be inbuilt feature provided to signal failures to the Substation Automation System, The meter shall be suitable to operate with power drawn from the VT supplies. The burden of the meters shall be less than 2 VA.

n) The power supply to the meter shall be healthy even with a single-phase VT supply. An automatic backup, in the event of non-availability of voltage in all the phases, shall be provided by a built in long life battery and shall not need replacement for at least 10 years with a continuous VT interruption of at least 2 years. Even under absence of VT input, energy meter display shall be available and it shall be possible to download data from the energy meter. In case data downloading is not possible in absence of VT supply, meter with provision of 220V DC auxiliary power shall be provided. Date and time of VT interruption and restoration shall be automatically stored in a non-volatile memory.

o) Shall have an optical port on the front of the meter for data collection from either a hand held meter reading instrument (MRI) having a display for energy readings or from a notebook computer with suitable software. The contractor shall supply the MRI and/or notebook complete with all optical interface unit required.

p) The meter shall have means to test MWh and MVARh accuracy and calibration at site in-situ and test terminal blocks shall be provided for the same.

q) Each meter shall have a unique identification code provided by the Owner and shall be permanently marked on the front of the meter and stored in the non-volatile memory of the meter.

r) Meters shall be immune to external influences like magnetic induction, vibration, electrostatic discharge, switching transients, surge voltages, oblique suspension and harmonics etc.

s) Communication Cables for the transfer of all SEM data to plant computers in control room shall be provided.

Type Test requirement for Energy Meter

All Type Test Reports shall be provided as per IEC 62052-11, IEC 62053-22, IS 14697.

PQ Meter

Suitable PQ meters (0.2 accuracy class) shall be provided at plant output for measurement of required electrical parameters such as active power, reactive power, power factor, voltage, current, frequency, power quality paraments, etc. PQ meter shall have TCP/IP port for SCADA and PPC

communication. Selected PQ meters shall be able to measure grid frequency with minimum two digits after decimal point. CT and PT/CVT core used for PQ meters shall have accuracy class of 0.2S and 0.2 respectively.

11.3.5 Time Resolution of Events and Time Synchronization

Resolution of dating of events for purposes of sequence of event recording shall be of 1milli second and time synchronizing shall be GPS based. The contractor will provide at least one GPS clock, which shall be synchronized with the SCADA system and all devices which are communicating with solar SCADA or directly with GPS Clock.

11.3.6 Time Synchronization Equipment

Time Synchronization equipments shall be provided and shall be located in the Control Room. It shall receive Coordinated Universal Time (UTC) transmitted through Geo Positioning Satellite (GPS) for time synchronization of all components of the SCADA. It shall be complete in all respects including antenna, all cables, processing equipment, etc.

All auxiliary systems and special cables required for synchronization of the equipment shall be supplied and commissioned by the Contractor.

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

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.

All components of the SWYD SAS, including Substation Controllers, Workstations, Bay Control Units (BCU) and Bay Protection units (BPU) 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. The architecture for the SAS shall be finalized during details engineering stage and same shall be in line with Transmission Utility/ CEA norms for ISTS Substations. As the bidder scope is only upto 33kV main Pooling Substation of GSECL, accordingly Switchyard SAS shall not be in bidder, however, necessary infrastructure required for interfacing of Solar Plant SCADA with GSECL network/ SCADA and other agencies network shall be in bidder's scope and same shall be as per the requirement of GSECL & other agencies.

It is the Contractor responsibility to send the all required data of solar plant and switchyard to SLDC/RLDC/ Transmission Utility. All required hardware's, software's, communication links and modification as per requirement shall be in the Contractor scope.

The GPS shall be synchronized with the SCADA system to be supplied under this contract and all devices which are communicating with Solar SCADA shall be synchronized with GPS. 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.

The system should be able to track more than 1 satellite at a time to ensure no interruptions of synchronization signals.

The system shall have provision for the combination of any of the following outputs signals:

- NTP (network time protocol)100 Mbits Ethernet port
- IRIG-B00x (TTL, pulse width modulated signal)
- 2 x pulse per half –hour/ Pulse per minute/Pulse per second output via potential free contacts
- Any other output port as may be required for the offered system.
- Alarm status contact indicating healthy status of system.

These output ports shall be compatible with the requirement of the equipment to be synchronized i.e. BCUs and BPUs. 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

The equipment should have a periodic time correction facility of one-sec. periodicity. The equipment shall also have real time display in hour, minute, second (24 hour mode).The master clock in control shall also be synchronized with the synchronization system and equipment should have display size approx. 140 mm height.

11.3.7 Telemetry Requirement

The arrangement to transmit required solar plant data to Load Dispatch Centre NLDC/RLDC/SLDC/WLDC/ Transmission Utility/ MNRE/ remote end substation of CTU / any other agency is in contractor's scope. Communication link and communication controller/Gateway used for data communication to FOTE panel/LDC etc shall be redundant (one for normal operation and other as hot standby). If any upgradation/ modification required at FOTE/ available park infrastructure of GSECL for telemetry etc ,it shall be done by the bidder.

Bidders are advised to update themselves with available GSECL infrastructure in Solar park etc for required interfacing and LDC etc requirement for compliance related to Automatic Meter Reading (AMR), telemetry data, channel and procedures for engineering of telemetry solution accordingly.

The above real time data communication facility with REMC/RLDC etc shall comply CERC (Communication System for Interstate Transmission of electricity) Regulation 2017, Procedure for Implementation of the Framework on Forecasting and Scheduling for Renewable Energy (RE) Generating Stations, CEA (Technical Standards for Communication System in Power Systems Operations) Regulations,2020 and amendments thereof.

The communication line lease charges initial as well as recurring annual charges during contractual O&M period will also be in contractor's scope.

11.4 Performance Guarantee

The Control and Monitoring System along with all auxiliaries and accessories shall be capable of performing intended duties under specified conditions. The Contractor shall guarantee the reliability and

performance of the individual equipment as well as of the complete system.

11.5 Design and Construction

11.5.1 Standards

The system and equipment shall be designed, built, tested and installed to the latest revisions of the IS/IEC/IEEE.

11.5.1.1 Layout

In Control Room, the following equipment shall be provided:-

i) Operator Workstations working as data server (under Plant control) with video display units, keyboards, pointing devices, printers etc

ii) Engineering Workstation

iii) High performance Data storage system (Redundant) for online automatic data storage with sufficient capacity to store plant Data, Devices and drives and necessary media for permanent backup of data on optical medium.

iv) Routers/ gateways for communication between Plant & Corporate Monitoring Centre, site office

v) Equipments for data Transfer to remote ends / Load Dispatch Centre (LDC)/ Transmission Utility/MNRE as per norms and requirements of concerned Transmission Utility, LDC,CEA etc.

vi) B/W Laser Jet Printer (1 No.) & 01 No. network A3 Printer

vii) LED Display(s)

11.5.1.2 Large Screen LED Display

Two LED based display, at least 80-inch overall diagonal Screen, with aspect ratio of 16:9 or better and high resolutions of at least 1920 x1080 pixels with necessary display controller and other accessories along with application software shall be provided. The concerned operator shall select the views from any of the available plant control views from any of the operator workstations. The display screen shall have a high viewing angle of at least 150° and shall have adequate level of brightness for display in ambient light conditions of the control room. A digital clock with date and time indication shall be provided on top of the display.

11.5.1.3 Operator Workstations

In the Control Room, two Operator Workstations (OWS) with desks shall be provided. The configuration of each workstation shall be having the following (but not limited to) features:-

Sr. No.	Feature	Parameters

1.	Video Display Unit (VDU)	02 no. Min 22" TFT Flat Monitor LED backlit and flicker-free Communication port:- 2 Serial bus , one parallel Dual 10/100/1000 Mbps. Ethernet Graphic Memory = 16 MB Expansion slot=3
2.	Processor (CPU)	Dual Processor 64 bit (i5 or equivalent)
3.	Memory	Minimum of 16 GB RDRAM
4.	Hard Disk	Min One (1) No. – Hard Disk Drives with latest technology of at least 1 TB capacity Ultra Wide RAID 1
5.	Removable Bulk Storage Drive	1 TB (Min)
6.	DVD R/W	16x or higher USB (3.0 or higher) hub & ports
7.	Keyboard	Functional keyboard with all functions and provision of shortcuts for alarms
8.	Pointing device	Mouse
9.	Additional general purpose software (for using over network by servers/ workstations/PCs)	Comprehensive disk maintenance utility for disk clean sweep/ crash guard/antivirus, etc.
10.	Software	MS. Windows latest, MS Office Editor (EXCEL,WORD, POWER POINT), Adobe Acrobat, Anti Virus, Network Security, Etc.

Printer

One no network printer of following configuration shall be provided

Sr. N0.	**Feature**	**Networked Colour Laser Printer**
1	Paper size	A3
2	Printing speed (Min) in normal mode for A4 Size paper	6 PPM (Colour) 24 PPM (B&W)
3	Type	Heavy duty, at least 50000 pages/ month
4	Resolution black (min)	600 dpi
5	First page out time	=<1 min for colour

	(with full graphic display)	<45 sec for B & W
6	Paper Input Capacity (Min)	500 sheets
7	Additional Features	Automatic Duplex Printing

11.5.1.4 Engineering Workstation (EWS)

One Engineering Workstation with separate desks shall be provided. The configuration of EWS shall be similar to that of Operator Workstations mentioned above except for the following items:-

1.	Memory	At least 16 GB of RAM upgradable to 24 GB (Min)
2.	Hard Disk	At least 1 TB Raid 1 Hard Disk with latest technology

These stations shall have the following features including software for:

i) Reprogramming,

ii) Process simulation,

iii) Program testing,

iv) Documentation,

v) Low level expert system tester,

vi) Training functions.

In addition to a desktop based EWS, vendor shall also provide dedicated portable laptop based EWS. The configuration of portable EWS shall be similar to that of Operator Workstation mentioned above.

11.5.1.5 Historical Storage and Retrieval System (HSRS)

The HSRS shall collect store and process system data from Man Machine Interface and Plant Information System (MMIPIS) data base. The data shall be saved online on hard disk and automatically transferred to non erasable 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.

The data to be stored in the above system shall be included alarm and event list, periodic plant data, selected logs/reports. The data/information to be stored and frequency of storage and retrieval shall be as finalised during detailed engineering.

The system shall provide user-friendly operator function to retrieve the selected data on OWS or printer in form of trend/report by specifying date, time & period. Further, suitable index files /directories shall also be provided to facilitate the same.

In addition to above, the system shall also have facility to store & retrieve important plant data for a very long duration (plant Life) on portable long term storage media. These data will include any data from the database

as well as processed /computed data based a various calculation/ transformation. The retrieved data from long term storage media should be possible to be presented in forms of alarms, logs, reports.

The configuration of HSRS shall be similar to that of Operator Workstation mentioned above; however, the disk capacity shall be sufficient to store at least 30 days data (Min 1 TB ultra wide raid 1) and no printer is required for HSRS.The printers provided with OWS shall be used through networking.

SCADA shall have facility to store long term data, days wise/ weekly/ monthly/yearly for 25 years for analysis and analytical reports to analyze the plant performance (PR) at various levels i.e. SCB, Inverter etc of Plant. For faster retrieval of long term aforementioned performance data, contractor shall offer time series data historian of 400 tags minimum for plant capacity up to 50 MW plants and additional 100 tags for every 10 MW or part above 50 MW however actual nos. of tags shall be determined based on the tag calculation.

Following plant performance (PR) long term data as a minimum with time stamping and interval as indicated in below table but not limited to shall be stored daily on historian for analysis and analytic report.

Important Plant Data for Very Long Duration (Plant Life) Storage

Sr. No.	Parameter	Time Interval
1	Meteorological Measurement data: Global Solar Irradiance on Horizontal & Inclined Plane, Diffuse Horizontal Irradiance, Ambient Temperature, Wind Speed, Wind Direction, Rain Fall and Relative Humidity etc.	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, SCB 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

11.5.1.6 Operating System

The operating system shall be latest Windows based network operating system available at the time of supply with a standardized, user friendly look and feel. All Servers shall be based on latest Enterprise edition of windows based Server operating system available at the time of supply.

11.5.1.7 On-line help and Diagnostic System (To be implemented on EWS)

Apart from the printed documentation manuals, the Contractor shall also provide all of his documentation online including equipment drawings and other details. The basic features of online help shall include but not restricted to the following:

i) Operator Manual detailing all aspects of the Control system

ii) Engineering drawings of equipment

iii) Maintenance Manual describing any maintenance duties which need to be carried out on the Control system

iv) Troubleshooting Guide out-lining how to resolve numerous difficulties and problems, which operators may encounter with either the control system or the equipment being monitored by the Control system.

11.5.2 Process Control Networks

11.5.2.1 Central Control Room network

A separate control room network shall be used in the control room to link the Operator's Workstations, Engineering Stations, and other peripherals. Central control Room network shall be redundant CAT 6 communication cables, based on the TCP/ IP Ethernet Standards at 100Mbps (Min) data transfer rate.

The routers, serial and digital interfaces of communication network, Ethernet switches etc should be provided with surge protection devices of suitable rating. If these devises are housed in common cabinet, Surge protection may be provided in each incoming power supply.

11.5.2.2 Plant Control Network

The data transmission between the RTUs / Data collector units and the workstations shall be implemented through a redundant fiber optic Plant Control Network. The network shall be based on ETHERNET standard and use of TCP/IP protocol. Minimum 100Mbps data transfer rate shall be used to guarantee fast and reliable data transmission. The redundant optical fiber buses shall preferably be routed through physically different paths.

11.5.2.3 Optical Fibre

Design of optical fibres shall be in accordance with recommendations and practices of relevant IEC standards and ITU-T series standards.

Optical source safety shut off shall be provided to prevent exposure to laser light during maintenance. Equipment shall have sufficient test points to facilitate complete monitoring of the equipment performance without service interruption. Fibres shall be designed to limit degradation after thirty years of intermittent exposure to stagnant water, ambient temperature and 100% relative humidity conditions.

The availability of 100Mbps data channel between two remote stations shall be greater than 99.99% and this availability shall consider a maximum mean-time-to-repair (MTTR) of 2 hours.

Optic Fiber cable shall be 8/12 core, galvanized corrugated steel taped armored, fully water blocked with dielectric central member for outdoor /indoor application so as to prevent any physical damage. The cable shall have multiple single-mode or multimode fibers on as required basis so as to avoid the usage of any repeaters. The outer sheath shall have Flame Retardant, UV resistant properties and are to be identified with the manufacturer's name, year of manufacturing, progressive automatic sequential on-line marking of length in meters at every meter on outer sheath.

The cable core shall have suitable characteristics and strengthening for prevention of damage during pulling viz. Steel central number, Loose buffer tube design, 4 fibers per buffer tube (minimum), Interstices and buffer tubes duly filled with Thixotropic jelly etc. The cable shall be suitable for maximum tensile force of 2000 N during installation, and once installed, a tensile force of 1000 N minimum. The compressive strength of cable shall be 3000 N minimum & crush resistance 4000 N minimum. The operating temperature shall be -20 deg. C to 70 deg. C. All testing of the optic fiber cable being supplied shall be as per the relevant IEC, EIA and other international standards. Bidder to ensure that minimum 50% (but not less 4) cores are kept as spare in all types of optical fiber cables. Cables shall be suitable for laying in conduits, ducts, trenches, racks and underground buried installation. Spliced/ Repaired cables are not acceptable. Penetration of water resistance and impact resistance shall be as per IEC standard.

11.5.3 Control Room Layout Design and Architecture

11.5.3.1 General

The control room layout and architecture shall be state of the art and aesthetically designed in synchronization and resemblance to the control room furniture / equipment by specialized vendors having proven track record in this field.

Control Room Layout Design and Architecture shall include, but not limited to the following:

i) Modular control desks shall be constructed of 3 mm thick CRCA steel plates. A 19 mm thick wooden top shall be provided on the desk to keep the TFT monitors at top and Computers inside. Each control Desk shall have two UPS input power supply and one raw power supply for operators and monitors.

ii) Modular printer tables made of laminated wood or heavy duty MDF and min 4 nos revolving chairs with wheels, provision for adjustment of height. Arm-rest in one piece shall be of

polyurethane and twin wheel castor of glass filled nylon. All the furniture shall be of reputed make (Godrej or Equivalent).

iii) Partitions

iv) Designer False ceiling

v) Glass and panel doors, walls, windows

vi) Panelling of walls, columns/beams etc.

All equipments, accessories and materials shall be designed, manufactured and tested in accordance with the latest applicable Indian Standards (IS) and IEC.

Various aspects should be considered and extreme care shall be taken while designing control room layout so as to create ideal work place. Physiological aspects such as line of sight & field of vision and cognitive factors such as concentration & perceptivity etc. shall be considered with special care.

11.5.3.2 Illumination

The contractor shall ensure compatibility of the control room lighting with the control and monitoring facilities to be provided, i.e., Large Screen Display and other facilities. The contractor shall provide “luminous ceiling” for the control rooms. Such “luminous ceiling” shall consist of concealed light fittings and architectural diffuser panels/diffuser bounce light of suitable size to ensure even lighting, perfect light distribution and minimal glare on display screens and control surfaces. Energy efficient LED luminaries suitable for false ceiling & wall mounted shall have to be provided to maintain 300 lux level, the quality class of direct glare limitations as 1 and better aesthetic look. Sufficient quantity of emergency lightings powered through inverter shall be provided.

The contractor shall coordinate with fire fighting agencies while finalizing the positioning of illumination fixtures and design of false ceiling.

11.5.3.3 Surveillance System

Proposed complete surveillance system should consist of 50 (Fifty) No’s fixed type Camera, 20 (ten) Nos PTZ type camera and 1(one) PTZ type camera for each inverter room/ inverter location. Location of installation of CCTV camera shall be decided during detail engineering. The resolution of Camera(s) should be of 1080P HD.

Cameras should be UL/ CE/ FCC certified and ONVIF profile S conformant. All the cameras should be connected to the central control room servers through LAN switches using CAT6/fibre optic cables as per applicable distance limitations.

In control room, system should be provided with rack mounted servers for recording of all the cameras without any limitation on no. of servers. Entire system should have scalable distributed client server based architecture and have single database for easy configuration, control and management.

System should be suitable for storage of minimum 30 days data with provision for enhancing the storage capacity if required.

Monitoring facility with monitor and joystick keyboard should be provided in central control room and security office. Monitor in central control room shall be of min 50" TFT Professional LED Display.

Required number of client workstations should be provided to interface these monitors and keyboards. Provision shall be provided to control and monitor these cameras from at least 3 client workstations concurrently (including remote access to Employer Project Office as well as Corporate Office – cost of any licenses etc shall be deemed included in the cost), whereas there should be no limitation over number of users.

The offered combination of camera types and video management software should be of proven design and satisfactory operation.

The supply and installation of power/ LAN cables from cameras to central unit/ distribution boards shall be in the scope of supply. The technical details of the components of surveillance system would be finalized at the detail engineering stage.

11.5.3.4 Air Conditioning:-

SCADA room, Office Room and Conference Room Rooms shall be air conditioned through energy efficient split (Five Star rated) type air conditioners. Air conditioning shall preferably be provided in other building as a functional requirement where control and relay panels, PLCC equipment, Optical Line Terminal Equipment, telemetry equipment and recording equipment shall be kept. For SCADA room, the air conditioning shall be through 24 x 7 duty industrial Split AC with Five Star Energy efficient rating.

The minimum sizes of above rooms have been mentioned in Technical Specification of Civil Works. However, If switchyard control and protection panels, PLCC panels, and transformer RTCC (if applicable) and fire alarm panels are proposed to be kept inside Main Control Room , then sufficient space with air conditioning (as applicable) in addition to above / mentioned in Civil works specification shall be provided considering the equipment size, OEM recommendations and maintenance access.

11.6 Drawings, Documents and Design Calculations

11.6.1 Design Memorandum

The Contractor shall submit to Employer a design memorandum prepared in accordance to clause 1.6 "Record and Documentation" of "Section 1-General Technical Requirements."

11.6.2 Drawings and Documents

The Contractor shall submit all the drawings and documents in accordance with requirements stipulated in "Section 2 – Technical Documents" of "General Technical Specification (GTS)".

11.7 Delivery, Installation and Commissioning

The Contractor shall follow the requirements of Delivery, Installation and commissioning elaborated in clause 1.7 Delivery, Installation and commissioning" of "Section 1 – General Technical Requirements

11.8 Spare Parts

Specified/mandatory spare parts shall be supplied at each plant location in accordance to clause 1.8 "Spare Parts" of "Section 1 – General Technical Requirements". Specified spare parts to be supplied under this section are as follows:

S.No.	Description	Quantity
1	Power Supply Modules/Unit	1 nos. of each type.
2	Meter Reading Instrument including cables (MRI for SEM)/ Laptop with cables etc (as applicable)	1 no.
3	SCADA Ethernet Switch	5% of total population for each type

11.9 Deleted

11.9.1 Deleted

11.10 Quality Assurance and Testing

The Contractor shall follow the quality assurance and testing requirements as per approved "Quality assurance and Testing Specifications (QTS)".

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12. PROTECTION SYSTEM

12.1. Scope of Work

Scope of work under this section covers the provision of labour, tools, plants, materials and performance of work necessary for the design, manufacture, quality assurance, quality control, shop assembly, shop testing, delivery at site, site storage and preservation, installation, commissioning, performance testing, acceptance testing, training of employer's personnel, handing over and guarantee for two years of Protection system at Solar Photovoltaic (SPV) Power Plant as per the specifications hereunder, complete with all auxiliaries, accessories, spare parts and warranting a trouble free safe operation of the installation.

The scope of work shall be a comprehensive functional system complete in every respect including but not be limited to following:

12.2 Scope of Supply

The Solar PV system and the associated power evacuation system shall be protected as per Indian Standards. Protection function shall be as per GSECL norms & requirement and applicable Standard/ Grid Code/ CEA Regulation. Over current relays, reverse power relays, differential protection relays and earth fault relays have to be essentially provided including the following wherever applicable.

12.2.1 Step-up Power Transformer & Transformer Bay Protection (Not applicable)

The protection relays shall be suitable for providing the following protection for 33/ 220kV Step-up Power Transformers & 220 kV transformer bays:-

- 87 Differential Protection
- 49 Winding Temperature Alarm and Trip Protection
- 26 Oil Temperature Alarm and Trip Protection
- 71 Oil Level Alarm and Trip Protection
- 50/50N/51/51N Instantaneous and time delay O/C & E/F Protection on HV & LV side
- 64R Restricted Earth Fault Protection.
- 59F Over Fluxing Protection
- 50Z Local Breaker Failure Protection
- 27 Under Voltage protection
- Any other protection as per requirement of GSECL

12.2.2 Transmission Line Bays Protection for both ends of Transmission Line (Not applicable for this package)

- 50 Z Local Breaker Failure Protection
- 21 Numerical Distance Relay Protection - Main 1 and Main 2 both Numerical
- 78 Power Swing Blocking Protection

- 67 Directional O/C and E/F Protection
- 79 Auto Reclosing (If required)
- 25 Check Sync Relay
- 27 Under Voltage Protection
- 59 Instantaneous and time delay Overvoltage Protection
- 97 CVT Fuse Failure Protection
- Fault Locator
- Any other protection as per requirement of GSECL
- Telemetry required for protection, data, voice etc. functions including equipments for necessary interfacing for completeness of the system shall be as per GSECL norms, requirements and applicable standard/ Grid Code/ CEA connectivity regulation

12.2.3 Bus bar Protection (Not applicable for this package)

- 87B Bus Differential protection
- 95 BB CT wire supervision relay

12.2.4 MV Switchgear Protection

Protection equipment for incoming, outgoing feeder and bus coupler bays of MV switchgear covering

- 50/50N/51/51N Instantaneous and time delay O/C &E/F Protection
- 27 Under Voltage Protection for incoming bays only

12.2.5 Station Supply Transformer (SST) / Auxiliary Transformer Protection

Protection equipment for Station Service transformers covering

- 49 Transformer Winding Temperature Alarm and Trip Protection
- 50/50N/51/51N Instantaneous and time delay Over Current and Earth Fault protection on HV as well as LV side
- 26 Oil Temperature Alarm and Trip Protection
- 71 Oil Level Alarm and Trip Protection

12.2.6 Other Protections and Provisions

- Protection of Inverters, Solar Power Transformers (SPT) etc. as per standard practice,
- Protection of 433 V Switchgear,
- AC and DC Supplies
- Necessary ICTs, relay panels, marshalling boxes, isolating and shorting links, etc
- Provision of necessary contacts and/or ports for integration with plant SCADA system for alarm, tripping & status signals as per the requirement
- Coordination with protection scheme of solar modules & inverters and

its associated equipment

- Any other protection as per requirement of GSECL
- Telemetry required for protection, data, voice etc. functions including equipments for necessary interfacing for completeness of the system shall be as per GSECL norms, requirements and applicable standard/ Grid Code/ CEA connectivity regulation
- One (1) set of spare parts in accordance to clause “Spare Parts” of this section,
- One (1) set of tools and instruments in accordance to clause “Tools and Instruments” of this section.

Any other item(s) not mentioned specifically but necessary for the satisfactory completion of scope of work defined above, as per accepted standard(s)/best international practices.

12.3 Specific Parameters and Layout Conditions

12.3.1 Layout and General Arrangement

Protection shall be provided through relays, which shall be Numeric type. Numeric protection for Power transformer shall be provided with 100% redundancy of relays.

The transmission line bays shall have distance protection with three stages with inter-tripping and blocking being carried out over a PLCC link/ OPGW (wherever applicable). Over current and earth fault protection through separate relay as a backup protection shall be provided.

The 33 kV incoming feeders shall be protected for instantaneous & time delay over current, earth fault protection and under voltage protection (50/51/50N/51N and 27 relays).

All outgoing feeders of 33 kV switchgear shall be protected for instantaneous & time delay over current and earth fault (50/50N/51/51N).The protection relays shall be installed on 33 kV switchgear.

415-volt incoming feeders from station service transformers/ Auxiliary Transformers shall be protected for instantaneous and time delay over current, earth fault and under voltage protection (50/50N/51/51N and 27 relays). The relays will be installed on 415V switchgear.

All required protection system for DC system shall be supplied along with DC system. The designer of protection system shall however, co-ordinate for making all necessary provisions.

Protection system shall be complete in all respect. The protection scheme shall also be coordinated with the fire protection system for step-up transformers & other areas. The detailed scope of supply given in relevant clause is indicative only. However, all protection as per relevant IEC standards shall be provided.

The requirement of number of current transformers may need to be examined and reviewed in view of the installation of latest state of art protection relays proposed to be installed.

All the relays shall be of reputed make with proven performance. The relay must be in operation for at least three years in three different power plants in equivalent voltage level substation.

In accordance of above, the type of protection shall have to be got approved from the employer before supply/despatch.

In case of Transformer faults, tripping signal from protection relays shall be hardwired for tripping of the 220kV circuit breaker on HV side & associated 33 kV breakers on LV side.

The contractor has to revise/upgrade the system during detailed engineering if the offered system does not meet all the requirements. The system should be state of art/latest model available at the time of supply.

If the protection system mentioned in the awarded contract become obsolete at the time of supply, the contractor shall offer a latest model without any extra cost.

12.3.2 Time Synchronisation

All relays, disturbance recorders, event recorders etc. shall be time synchronised through universal time synchronisation system as described in “Section -Control and Monitoring (SCADA) System”.

12.4 Rating and Functional Characteristics

The system shall provide a high degree of selectivity and discrimination between faulty and healthy circuits. A microprocessor based modular system associated with a human machine communication interface shall be preferred.

All devices shall remain inoperative during internal faults and transient phenomena. They shall be insensitive to mechanical shocks, vibration and external magnetic fields. All relays shall be suitable for local and remote reset. They shall have self-monitoring facilities and LED status indication. Service voltage failure and any fault in relays and tripping circuitry shall be indicated.

Tripping circuits shall be operable at 70 % nominal voltage. CTs shall be shorted automatically, when relevant modules are withdrawn. Main and back up protection system shall be separated and shall have individual power supply from different source.

The relays shall be provided with the following information, suitably located:

- Function of relay,
- Phase identification,
- Main characteristics.

12.5 Performance Guarantee

The protection system along with all auxiliaries and accessories shall be capable of performing intended duties under specified conditions. The Contractor shall guarantee the reliability and performance of the individual equipment as well as of the complete system.

12.6 Design and Construction

12.6.1 Standards

The system and equipment shall be designed, built, tested and installed to the latest revisions of the following applicable standards. In the event of other standards being applicable they will be compared for specific requirement and specifically approved during detailed engineering for the purpose:

Standards	Description
IEC 60255	Electrical relays
IEC 60870-5-103	Telecontrol equipment and systems
IEC 60044-2	Instrument transformers - Part 2 : Inductive voltage transformers
IEC 60044-1	Instrument transformers - Part 1 : Current transformers
IEC 60044-6	Instrument transformers - Part 6 : Requirements for protective current transformers for transient performance

The Contractor shall submit for the employer's approval, a design report detailing the protected equipment, design parameters of associated current transformers, details of connections and burden between current transformers and relays, details of the relays circuits and performance calculations.

12.6.2 Numeric Relay

The numerical relay shall have at least following features

- The relay used in protection system shall be of the numerical, and plug in type arranged in protection cubicles. All relays including all ancillary devices, such as interposing transformers, tripping matrix and relays, test facilities, power supply units, etc. with all circuits shall comply with IEC 60255 recommendation,
- All communications of protection system with the control system shall be based on universally accepted protocol namely IEC 60870-5-103,
- There shall be one RS232 ports on front and one RS485 on rear. The front port shall be used to connect the laptop locally for any change in settings/downloading the data etc. and the rear port shall be used to inter connect the relays and for remote setting/auto extraction of disturbance/events etc.The RS 232 and Rs 485 cables connecting with the controller must be provided with surge protection devices as per IEC 61643-21.
- Laptop provided with SCADA (or other equipment) shall be used to facilitate numerical relay configuration, DR and event/fault records downloading from relay locally. Latest version of hardware and Software for interfacing the numerical relays with laptop shall be provided. SCADA Laptop detailed configuration must ensure suitability for the required applications. At least two sets of

communication cable for Laptop to relay communication shall be provided.

- The relay shall have preferably front panel back lit display,
- The relay shall have self monitoring features,
- All major numerical relays shall have an inbuilt disturbance recorder (DR) and event recorder,
- DR shall have at least 8 Analog and 16 Digital channels with a scan rate of minimum 1000 Hz. The output of DR should be available on COMTRADE format to enable replay on Numerical test kits. Software and hardware shall be provided for analyzing the records.
- The event recorder shall be capable of storing a minimum of 256 digital signals including time marker with a resolution of one millisecond.

12.7. Mechanical/ Electrical Protection

12.7.1 General

The mechanical protection shall be connected to the relevant protective devices or sensors as described in the respective sections. The mechanical protection shall consist of the necessary relays, as applicable, connected to one or a group of protection devices or sensors, and a tripping unit as described in design requirements. The protection sensors and devices are described in the relevant sections and shall be wired to terminal blocks in different wiring cubicles.

12.7.2 Power Transformer Protection

The following features shall be furnished for the transformer protection.

12.7.2.1 Differential Protection

Transformer Differential protection shall be provided for the detection of phase and earth faults on the transformer windings. The protection shall be of the three winding biased differential type fed from current transformers on the high voltage & low voltage side of the transformer.

The scheme shall have magnetizing in rush current restraint of the harmonic type and shall have individual adjustment of operation and bias settings. All necessary interposing transformers shall be provided which shall be adequately rated to ensure correct relay performance during maximum through-fault condition.

The minimum operating settings shall not be more than 20 per cent of rated full load of the current transformers.

12.7.2.2 Restricted Earth Fault Protection

Transformer windings and connections shall be protected by restricted earth fault (REF) protection. Each relay shall have an instantaneous trip attachment. The fault setting shall be between 10 per cent and 60 per cent of the rated current of the protected winding.

The rated stability limit shall not be less than the maximum current available for an external fault. This shall be taken as 16 times the rated current. Separate current transformers (i.e. not sharing transformer biased differential protection) are preferred.

12.7.2.3 Over Fluxing Protection

This system shall protect the step-up transformer iron core from excessive heating in case of voltage rises and/or frequency dips during unit operation.

12.7.2.4 Buchholz Protection

All oil type transformers shall be fitted with Buchholz devices of the two-element type giving operation under gassing and under surge conditions.

12.7.2.5 Oil and Winding Temperature

Transformers will be provided with oil and winding temperature protection. These will be of the two stage type with adjustable settings giving alarm and trip facilities. Transformer protection shall also include:

- Differential pressure alarm and trip,
- Sudden pressure release alarm and trip,
- Low/high oil level alarm,

- Low oil and water flow alarm.

Each trip relay shall be arranged to operate onto both trip coils on the HV circuit breaker on HV side & associated MV breaker on LV side.

12.7.3 Bus Bar Protection

Bus bar protection of the high speed, low impedance, circulating current type shall be provided capable of detecting three phase, phase-phase and phase to earth faults, under all system conditions.

The operating time of the measuring relays shall be as short as possible consistent with reliable and secure operation.

The bus bar protection shall be fed from separate CT cores reserved for it.

12.7.3.1 Bus Bar Supervision Protection

Automatic and continuous supervision of current transformer circuits shall be provided to give an alarm when the out-of-balance current reaches an undesirable value. Operation of current transformer supervision equipment should block the protection after a time delay and shall initiate an alarm.

12.7.3.2 Bus Bar Differential Protection

Three phase bus bar differential protection including the number of systems and auxiliaries required for the complete bus bar protection system for the switchyard.

The bus bar protection shall have the following features:

- The bus bar protection system shall have two criteria. One is to check overall bus differential current without using isolator contacts. The other criteria is to check discriminating zone bus differential current with isolator contacts.
- Each circuit-breaker trip relay shall be arranged to trip both trip coils on the circuit breaker, i.e., each circuit breaker shall receive two trip commands for a fault. In the case of feeder circuits, operation of bus bar protection trip relays/ LBB shall initiate direct transfer tripping of the remote end circuit breaker via PLCC. Suitable voltage limiting devices should be provided as necessary.

High speed differential bus bar protection shall cover following features:

The rated stability limit shall not be less than the three phase symmetrical breaking capacity of the associated switchgear. The fault setting for any type of fault shall not exceed 30% of the minimum fault current available.

Current transformer knee, point voltages shall not be less than twice the relay circuit setting voltage. The maximum peak voltage across current transformer secondary wiring shall not exceed 3kV under maximum internal fault conditions. Associated current transformers shall be class PS, low reactance type. Split core type current transformers will not be accepted.

12.7.3.3 Breaker Failure Protection

Breaker failure protection shall be fitted to all HV circuit breakers in the transformer bays. The breaker failure protection on a circuit breaker shall

be initiated by all the other protection devices, which normally initiate tripping of that breaker.

In the event of the circuit breaker failing to open within a pre selected time, the breaker failure protection shall initiate tripping of all adjacent CB's connected to the same bus bar, and direct transfer tripping of the line breakers, via tele-protection channels over PLCC/ OPGW (as applicable) as appropriate.

12.7.4 Overhead Line Protection

The following features shall be furnished for the overhead line protection, wherever, applicable

(i) Distance Protection

Distance protection shall be non-switched numerical type, comprised of minimum three-zone distance operation. The distance protection shall operate for all types of phase and earth faults. Separate phase and earth fault distance measuring elements shall be provided. Phase and earth fault compensation features shall be incorporated to ensure accurate distance measurement for all types of fault and to allow for variation in the path of earth faults on the system.

(ii) Over Voltage Protection

The transmission line shall be protected for over voltage. The over voltage relay setting for over voltage steps from 100% to 120% in steps of 2.5% each for time delayed protection. For instantaneous over voltage protection, the setting will be110% to 150%. Relay setting shall be decided after observing grid condition at time project commissioning.

(iii) Automatic Re-closing (if required)

Three pole and/or single shot repetitive auto re-closing equipment shall be provided for overhead line circuit breakers, and shall include, where necessary, dead line and check synchronizing relays. Re-closing shall only take place on overhead line circuits and shall be initiated by following tripping by the distance relay Zone 1 equipment or on receipt of a permissive inter tripping signal.

12.7.5 Control and Tripping Circuitry

The tripping circuits shall be accomplished via a tripping MATRIX. The MATRIX shall include all electrical and mechanical signals as per alarm/tripping schedule and sequence diagram.

Trip circuit supervision systems shall be provided. They shall preferably supervise the circuits continuously irrespectively of circuit breaker position whether it is closed or open. Supervisory systems combined with automatic test facilities will also be considered.

Any fault in a tripping circuit shall be enunciated individually. The trip circuits shall not be interrupted during test procedure. Correct working shall be indicated by LED's.

For relay testing and setting by means of a portable, precision test set all required circuits shall be terminated to test plugs/switches, arranged at easily accessible locations. An appropriate test set with all accessories shall be included.

12.7.6 Power Supply Requirements

DC shall be provided for the power supply to the control and protection of AC switchgear equipment, while AC shall be provided for the power supply to the control and protection of DC switchgear.

Both systems shall be used to supply auxiliary voltage and tripping voltages to the protection system.

All components of the protection system shall function properly at DC voltages from 80%-115% of nominal voltage.

If short-circuit protection is needed inside each protection group, mini circuit breakers shall be used, having auxiliary contacts for initiating alarm for open position. Converters and suppression filters shall be provided for each protection part. The converters shall have high insulation level, and shall be equipped with internal fault detection, initiating alarm upon failure in the converter.

The protection systems shall be fed by the 220 V/110 V battery banks (wherever applicable). Relay shall be suitable for operation on 220V/ 110 V DC systems without the use of voltage dropping resistors.

Each DC supply shall be designed to protect it from high voltage and surge and provide electrically isolated contacts for annunciation.

Relays shall utilize a DC-DC converter type regulated power supply to provide transient surge isolation between the station battery and protection equipment. The supply units shall be equipped with input filters to protect against external voltage peaks.

Protection shall be provided in the primary and secondary circuits of the DC transducers. The supply voltage and all secondary voltages produced by the DC /DC transducers shall be monitored.

The protection systems shall have double in feed with main switch, DC /DC transducers, stabilizers and voltage monitors.

Redundancy shall be obtained by de-coupling the two DC/DC transducers by diodes so that, on failure of one circuit, the power supply can fully be maintained.

In case of supply voltage drop the auxiliary voltage shall be maintained for 50 milli second.

12.8 Drawings, Documents and Design Calculations

12.8.1 Design Memorandum

The Contractor shall submit to Employer a design memorandum prepared in accordance to clause “Record and Documentation” of “Section 1- General Technical Requirements.”

12.8.2 Drawings and Documents

The Contractor shall submit all the drawings and documents in accordance with requirements stipulated in “Section- Technical Documents” of “General Technical Specification (GTS)”.

12.8.3 Design Calculation

The Contractor shall submit the design calculation in accordance to Clause 2.4 of "General Technical Specification (GTS)" covering at least the following, for review/acceptance.

- Complete protection scheme coordination,
- CT and PT application check,
- Setting for different relays,
- DC power requirements.

12.9 Delivery, Installation and Commissioning

The Contractor shall follow the requirements of Delivery, Installation and commissioning elaborated in clause "Delivery, Installation and commissioning" of "Section 1 - General Technical Requirements."

12.10 Spare Parts

In accordance to clause 1.8 "Spare Parts" of "Section - General Technical Requirements". Specified spare parts to be supplied at each plant location under this section are as follows:

S. No.	Description	Quantity
1	Protection Relays	1 no. of each used type

12.11 Deleted

12.11.1 Deleted

12.11.2 Deleted

12.12 Quality Assurance and Testing

The contractor shall follow quality assurance and testing requirements as per approved "Quality Assurance and testing specifications (QTS)".

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13 33 KV SWITCHGEAR

13.1 Scope of Work

Scope of work under this section covers the provision of labour, tools, plants, materials and performance of work necessary for the design, manufacture, quality assurance, quality control, shop assembly, shop testing, delivery at site, site storage and preservation, installation, commissioning, performance and acceptance testing, training of Employer's personnel, handing over to the Employer and guarantee for two years of 33kV switchgear for Solar Photovoltaic (SPV) Power Plant and as per the specifications hereunder, complete with all auxiliaries, accessories, spare parts and warranting a trouble free safe operation of the installation.

The scope of work shall be a comprehensive functional system covering all supply and services including but not be limited to following:

13.1.1 MV Switchgear System

The switchgear system of 33kV shall consist of following major items:

i) Incoming Panels from field units/ blocks to local / Sub Pooling Switchgear.

ii) Requisite nos. of outgoing panels including cable and other associated equipment for interconnection of MV switchgear between two locations.

iii) Panels for 33kV/.433V Station Service Transformer (if applicable)

iv) Requisite numbers of Bus Couplers Breakers

v) System fault current rating of 33 kV Switchgear shall be 25 KA for 1 sec and Dynamic withstand Current rating as 2.5 times of system fault current.

vi) The switchgear shall be cooled by natural air flow. Forced cooling shall be considered in case current rating is 2000 A or above.

vii) Spare Parts in accordance to clause 13.8 "Spare Parts" of this section.

viii) Tools and Instruments in accordance to clause 13.9 "Tools and Instruments" of this section

All the 33kV switchgear panels shall be complete with cubicles, protection, metering, bus-bar system, cabling, wiring and other accessories, each comprising of following major equipment

1. 33kV Vacuum/ SF6 Circuit Breaker
2. AC Bus bars (including N-bus bar, if required),
3. Current Transformers and Potential Transformers as per requirement
4. Surge Arrester as per system requirement
5. Digital Multifunction Meters as per requirement

6. Energy Meters as specified in section for "Control & Monitoring System".

The quantities shall be finalised during detail engineering based on the proposed configuration.

13.1.2 Miscellaneous Components and Auxiliary System

i) All necessary auxiliaries for control and supervisory circuits, local control switches, Indicators and other relays as required,

ii) All secondary wiring, terminal blocks, labelling and nameplates, sockets etc.

iii) Cubicle lighting including lighting fixtures and power sockets,

iv) Cubicles heating including heating elements,

v) All protection relays and systems for transformer and switchgear as elaborated in "Section Protection System",

vi) Coordination and provision of necessary contacts and/or ports for integration with plant Control and Monitoring system,

vii) Spare parts in accordance to clause 13.8 "Spare Parts" of this section.

viii) Tools and instruments in accordance to clause 13.9 "Tools and Instruments" of this section

Any other item(s) not mentioned specifically but necessary for completion of the system and its interfacing with other associated systems shall be scope of supply.

13.2 Specific Parameters and Layout Conditions

13.2.1 Layout and General Arrangement

The system offered for the 33kV switchgear scheme shall be as per the Single Line Diagram including all required provisions for interlocking scheme.

13.3 Rating and Functional Characteristics

13.3.1.1 MV Switchgears

Sl. No.	System Description	
1)	Location	Indoor/ Outdoor
2)	Type of Earthing	Solidly earthed
3)	Rated System Voltage, kV, r.m.s	33
4)	Highest System Voltage, kV, r.m.s	36
5)	Rated Frequency, Hz	50

6)	Rated Insulation Level: Rated One Minute Power Frequency Withstand Voltage Lightening Impulse withstand voltage with 1.2 / 50 Micro second wave	70 (r.m.s) 170 (Peak)
7)	Rated Short Time Withstand Current (r.m.s)	25 KA for 1 sec (Min)
8)	Rated Normal Current, A (Bus Bar)	As per requirement
9)	Control Voltage DC	220V/ 110V (+10 % /-10%) (-20% for CB Trip coil)
10)	Auxiliary AC Supply, 3 Phase	415 ± 10% V
Circuit Breaker		
11)	Type	Vacuum /SF6
12)	Description	Three phase equipped with group control mechanism
13)	No. of Interrupter Unit per Pole	1
14)	Rated Normal Current, A	As per each feeder requirements
15)	First-Pole-to Clear Factor	1.5
16)	Rated Short Circuit Breaking Capacity, kA (r.m.s)	25 kA
17)	Rated Short Circuit Making Capacity, kA (r.m.s)	2.5 times system fault current
18)	Rated Cable Charging Breaking Current, kA (Peak)	25 A
19)	Rated Operating Sequence	O-0.3Sec-CO-3min-CO
20)	Total Break Time	Not more than 4 cycles
21)	Total Make Time	Not more than 5 cycles
22)	Normal Voltage for Operating Mechanism i.e., charging motor (DC/AC)	85 % and 110 % of the rated supply voltage
23)	**Current Transformer**	
	Current Ratio	As per system Requirement
	Accuracy Class For Differential and REF Protection	PS
	Accuracy Class For other Protection	5P20
	Accuracy Class For Metering	0.2S FS 5/ 0.5 for CTs of low turn ratio
24)	**Potential Transformer**	
	Transformation Ratio	As per system requirement
	Accuracy Class Protection	3P
	Accuracy Class Metering	0.2
	Rated Voltage Factor	1.2 times continuous

*Outdoor MV/ HT switchgear can also be offered for local / sub pooling. Bidder may directly connect inverter duty transformer to 33 kV local / Sub pooling switchgear, if the distance between Inverter duty Transformer and local / Sub pooling switchgear is less than 50 meter. If the distance is more than 50 meters, an ICOG type breaker shall be provided at IDT end. Outgoing of ICOG shall be connected to the Sub pooling switchgear through suitable size cable. Outdoor/ Indoor switchgear shall have minimum IP 55/ IP4X respectively. The bidder shall submit the relevant details of the switchgear including the datasheets, drawings and applicable type test reports during the detailed engineering for Employers approval. For metal enclosed outdoor HT switchgear, pooling switchgear on the LT side (if applicable) from string inverter to inverter transformer, suitable shed shall be provided considering the O&M space.

13.3.2 Current Ratings and Short Circuit Capabilities

The complete 33 kV switchgear shall be designed to be capable of withstanding without damage all stresses by maximum symmetrical short circuit (peak) currents in the bus bar and in the incoming and outgoing bays.

The complete design and layout shall be subject to approval by the Employer.

13.4 Performance Guarantee

The 33kV switchgear along with all auxiliaries and accessories shall be capable of performing intended duties under specified conditions. The Contractor shall guarantee the reliability and performance of the individual equipment as well as of the complete system.

13.5 Design and Construction

13.5.1 Standards

The system and equipment shall be designed, built, tested and installed to the latest revisions of the following applicable IS/IEC standards. In the event of other standards being applicable they will be compared for specific requirement and specifically approved during detailed engineering for the purpose:

Sl. No.	Standards	Description
1	IEC 60529	Degrees of Protection provided by enclosures (IP Code)
2	IEC 61869-2	Instrument Transformers - Part 2 : Additional Requirements for Current Transformers
3	IEC 61869-3	Instrument Transformers - Part 3 : Additional Requirements for Inductive Voltage Transformers
4	IEC 62271-100	High Voltage Switchgear and Control gear – Part 100: High Voltage alternating-current circuit-breakers

Sl. No.	Standards	Description
5	IEC 62271-200	High Voltage Switchgear and Control gear – Part 200: A.C. metal-enclosed switchgear and control gear for rated voltages above 1 kV and up to and including 52 kV
6	IEC 60694	Common specifications for High-Voltage switchgear and control gear standards
7	IS: 8130 –1984	Conductors for Insulated Cables

13.5.2 33kV Switchgear

13.5.2.1 General

The 33kV Switchgear shall be of the steel enclosed type vermin proof, dust protected and shall comply with the requirements of latest edition of IEC/IS. The switchgear shall be complete with circuit breakers, dry type instrument transformers, bus bars, earthing arrangements, instruments and protective relays, labels, cable end boxes, glands, all necessary wiring and auxiliary devices required to perform its functions. The switchgear shall be of the indoor design and comprise of following four compartments and each compartment shall be segregated by earthed metalled partition:

i) Main Bus bar Compartment

ii) Cable Connection Compartment

iii) Circuit Breaker Compartment

iv) Low Voltage Compartment

The switchgear should be internal arc tested. The 33 kV switchgears (both indoor and outdoor type) shall have an internal Arc Classification of IAC FLR 25kA, 1sec. Bus bars, cable end boxes, potential transformers and breaker orifices shall be provided with independently operated automatic metallic shutters to avoid accidental contact with live parts.

The closing coil and spring charging motor shall operate satisfactorily at all values of control supply voltage between 85% to 110% rated DC voltage. The shunt trip coil shall operate satisfactorily under all operating conditions of the circuit breaker up to its rated short circuit breaking current at all values of control supply voltage between 70% to 110% of rated DC voltage. The trip coil shall be so designed that it does not get energized when its healthiness is monitored by two indicating lamps (Red) and one trip coil supervision relay.

The end section of panel shall be provided with blank plates with provisions to facilitate further bus bar extension on either side.

To represent the single line diagram, a mimic diagram shall also be made available on the panel. The circuit breaker cubicle shall be provided with space heater and door operated illumination lamp.

All incoming and outgoing feeders of 33kV Switchgear shall be protected for instantaneous and time delay over current and earth fault (50/51/50N/51N).

Necessary CT and relays for Differential Protection for Power transformer shall be in the scope of 33kV switchgear panel.

Restricted Earth fault relay for HV side Power transformer shall be in scope of 33kV switchgear supplier.

The system shall be compatible with station SCADA, regarding input and output needed for operation, control & monitoring of 33kV switchgear system.

13.5.2.2 Bus Bars

All the bus bars within the switchgear assembly shall be air insulated group enclosed and shall have adequate rated current capacity. Bus bars shall have mechanical and thermal capacity of not less than that represented by the short time current rating of circuit breakers. The bus bars shall be of high conductivity Aluminium alloy/ Copper conductors conforming to IEC/IS. The contractor shall submit detailed load calculation to prove adequacy of rated current of bus bar with sufficient margins.

13.5.2.3 Circuit Breaker

The 33kV circuit breakers shall be vertically mounted, horizontal draw out and horizontal isolation type of latest generation, electrically trip free, with anti pumping device and operated by means of motor charged and/or stored energy type spring mechanism

Motor operating mechanism shall have provision for closing / opening of breaker manually and an interlock shall be provided between electrical and manually operating modes for either electrical or manual operation. Circuit breaker shall be according to IEC/IS and shall be complete with the proper interlocking.

13.5.2.4 Current Transformer

The current transformer shall be of inductive type. It shall be mounted within the cubicles and shall comply with the requirements of relevant IEC/IS. It shall be used for protection and metering.

13.5.2.5 Potential Transformer

The potential transformer shall be of inductive type. It shall be mounted within the cubicles on a withdrawable trolley independent of the trolley for the circuit breaker and shall comply with the requirements of relevant IEC/IS.

The potential transformer at bus bar shall be of two cores used for metering and protection / interlocks. The potential transformer at incoming bays shall be of two cores one used for protection / interlocking and other for metering.

13.5.2.6 Surge Arrester

The surge arrestors shall be provided as per system requirement and shall be of metal oxide, gapless type generally in accordance with IEC 60099-4 and suitable for indoor duty. These shall be mounted within the switchgear cubicle between line and earth, preferably in the cable compartment.

Surge arrestor selected shall be suitable for un-earthed system and rating shall be in such a way that the value of steep fronted switching over voltage generated at the switchgear terminals shall be limited to the requirements of switchgear.

13.5.2.7 Insulating Mats

Insulating mats of appropriate size confirming to relevant standards are to be provided in front of all the 33kV switchgear panels for the safety of personnel.

13.5.3 Control Description

13.5.3.1 General

Each Vacuum/SF6 circuit breaker shall be equipped with facilities for remote operation. Each circuit breaker unit shall be equipped with a Local/Remote selection switch, local on/off push button and an indicator showing the position of the breaker in the control room. The circuit breaker shall be operable with the breaker in test position. Auxiliary contactors with an alarm contact for remote indication of tripped condition shall be provided for protection of control circuits. All circuit breaker shall be equipped with trip circuit supervision device.

Auxiliary contacts shall be wired to terminal blocks for remote indications of the circuit breakers.

13.5.3.2 Metering and Protection

All instruments and control switches mounted in the switchgear shall be in accordance with “Section – Computerized Control and Monitoring System” and “Section – Protection System”. Instruments shall be furnished with all necessary resistors, shunts etc.

The bus bar voltage metering shall contain potential transformer. All metering circuits shall be terminated in terminal blocks for remote metering purposes.

13.5.3.3 Interlocks

The 33kV switchgear Bus will be divided into sufficient number of section with bus coupler breakers to minimize the generation outage the interlocking of these bus coupler breakers will be finalized during detailed engineering. The 33kV breakers shall be provided with under voltage tripping so that to isolate the invertors from the grid in case of invertors being shutdown/ fault. 33kV breakers used for Power Transformer and Station Service Transformer will not be provided with under voltage tripping.

13.5.3.4 Remote Control/ Monitoring

Necessary provision/potential free contacts shall be made available for control, status, alarm and indication of at least following faults/status at Main Control Room:

i) 33kV Switchgear Operation Mode (Local / Remote)

ii) Open/Closed/Trip/Test positions of Circuit Breakers

iii) ON/OFF Remote commands for Circuit Breakers

iv) Measurements on each feeder (Voltage-each phase, Current-each phase, Power, Energy etc.)

v) Each Fault conditions

vi) Any other suitable for system requirement

13.6 Drawings, Documents and Design Calculations

13.6.1 Design Memorandum

The Contractor shall submit to Employer a Design Memorandum prepared in accordance to clause 1.6 “Record and Documentation” of “Section 1- General Technical Requirements.”

13.6.2 Drawings and Documents

The Contractor shall submit all the drawings and documents in accordance with requirements stipulated in “Section 2 – Technical Documents” of “General Technical Specification (GTS)”.

13.6.3 Design Calculation

The Contractor shall submit the design calculation in accordance to Clause 2.4 of “General Technical Specification (GTS)” covering at least the following, for review / acceptance

i) Rating of CTs and PTs

ii) Temperature Rise calculations of the bus bar

iii) Short Circuit Withstand Capacity

iv) Load calculation for Busbar rating selection

13.7 Delivery, Installation and Commissioning

The Contractor shall follow the requirements of Delivery, Installation and commissioning elaborated in clause 1.7 “Delivery, Installation and commissioning” of “Section 1 – General Technical Requirements.”

13.8 Spare Parts

In accordance to clause 1.8 “Spare Parts” of “Section 1 – General Technical Requirements”. Specified spare parts to be supplied under this section are as follows:

S. No.	Description	Quantity
1	Under voltage relays	2 no.
2	Over current and earth fault relays	1 no
3	Current Transformers	1 no. of each used type
4	Potential Transformer	1 no. of each used type

S. No.	Description	Quantity
5	33 kV Circuit Breaker Complete	2 no. each type for sub pooling and 01 no each type for ICOG
6	33 kV Surge Arrester	02 no of each type and rating
7	Numerical Relay for 33 kV Switchgear (Inverter Station and Sub pooling)	02 no each type used

13.9 Tools and Instruments

The Contractor shall supply all necessary tools and instruments etc. for installation, repair and maintenance in accordance to clause 1.9 “Tools and Instruments” of “Section 1 - General Technical Requirements”.

The proposed list of tools must include the following

i) 01 No number Breaker Handling Trolley at each sub pooling Switchgear Room/ Location

ii) Two numbers Spring Charging Handle,

iii) Racking Handle for each breaker.

iv) One each Earthing Truck for Cable & Bus Bar Earthing at each sub pooling Switchgear Room/ Location

13.9.1 Deleted

13.10 Quality Assurance and Testing

The Contractor shall follow the quality assurance and testing requirements as per approved “Quality assurance and Testing Specifications (QTS)”.

13.10.1 Test

33kV Switchgear 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 this 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.

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14. LT SWITCHGEAR

14.1. Scope of Work

Scope of work under this section covers the provision of labour, tools, plants, materials and performance of work necessary for the design, manufacture, quality assurance, quality control, shop assembly, shop testing, delivery at site, site storage and preservation, installation, commissioning, performance testing, acceptance testing, training of Employer's personnel, handing over and guarantee for two years of LT Switchgear for Solar Photovoltaic (SPV) Power Plant and as per the specifications hereunder, complete with all auxiliaries, accessories, spare parts and warranting a trouble free safe operation of the installation.

The scope of work shall be a comprehensive functional system covering all supply and services including but not be limited to following:

14.1.1. LT Switchgear

3-phase, 50 Hz, 415 V (230V in case of Single Phase) switchgear system would consist of various LT Switchgear boards as per the requirement. The scope would include one (1) lot of standard load distribution boards complete with cubicles, protection, metering, bus-bar system, cabling, wiring and other accessories, each comprising of following major equipment and the quantities/ratings shall be finalised during detail engineering.

All the above boards shall be metal enclosed switchgear type, complete with suitably rated

- Draw out type Air Circuit Breaker (For above 400 A) / MCCB (For 400 A & below), for incoming and bus coupler feeder. Suitable changeover and interlocking arrangement shall be provided for incomers and bus coupler.
- Required no. of MCB/ MCCBs in outgoing feeder
- Required no. of Current Transformers & Potential Transformers,
- Required no. of Multifunction Meters,
- All necessary AC Bus bars (including N-Bus bar),
- Local Control Switches,
- Indicators (LED Type) as per requirement,
- All necessary auxiliaries for control and supervisory circuits, and other relays as required,
- Other additional feeder units necessary to fulfil the requirements of the specification and sockets etc.,
- All secondary wiring, terminal blocks, labelling and nameplates, sockets etc.,
- Cubicle lighting including lighting fixtures and power and communication sockets,

- Cubicles heating including heating elements.
- Spare parts in accordance to clause 14.8 “Spare Parts” of this section.
- Tools and instruments in accordance to clause 14.9 “Tools and Instruments” of this section

i) All protection relays and systems for switchgear as elaborated in Plant Protection System. Under voltage Protection shall be in incoming breaker panel only.

ii) Coordination and provision of necessary contacts and/or ports for integration with plant SCADA system

Any other item(s) not mentioned specifically but necessary for the satisfactory completion of system will be scope of supply.

14.2. Specific Parameters and Layout Conditions

14.2.1. Layout and General Arrangement

The switchgear system is solidly grounded, 3 phases,4-wire TNS/ 1 Phase, 3 wire, according to IEC Publication 60364-3. These LT boards shall be installed for redundancy and reliability of power supply to various connected loads. Suitable changeover and interlocking arrangement shall be provided for incomers and bus coupler. The on/off/ trip status shall be provided in SCADA System.

It shall be the responsibility of the Contractor to complete the work in all respect and to make the scheme functional as per single line diagram. The LT switchgear along with all auxiliaries and accessories shall be capable of performing intended duties under specified conditions. The Contractor shall guarantee the reliability and performance of the individual equipment as well as of the complete system.

14.3. Rating and Functional Characteristics

14.3.1. 415 V System & Switchgear

POWER SUPPLY (AC SYSTEM)

a)	Voltage	415V ± 10%, 3 Phase, 4 wire, Neutral Solidly Earthed
b)	Frequency	50 Hz +/- 5%
c)	Minimum System Fault Level	As per System Requirement (for 1 sec)
d)	Short Time Rating for bus bars, Circuit Breakers, Current Transformers and Switchgear Assembly	As per System Requirement (for 1 sec)
e)	Maximum Ambient Air Temperature	50 deg. C

BUS BARS

a)	Continuous Current rating at 50ºC ambient:	As Per Requirement
b)	Material	Copper/ Aluminium
c)	Temperature Rise allowed above ambient	40 deg. C for plain joints 55 deg. C for Silver plated joints

MCCB

a)	Rated Voltage	415V/230 V
b)	Rated Insulation Level	690V
c)	Rated ultimate and service SC Breaking Capacity	As per System Requirement (for 1 sec)
d)	Rated Making Capacity	2.1 times of System fault current
e)	Utilization Category	A

DIGITAL MFM

a)	Accuracy Class	0.5
b)	Communication with SCADA	MFM shall be provided at LT incomer feeder. MFM shall have suitable communication port for integration with SCADA system.

CURRENT TRANSFORMERS

a)	Type	Cast Resin
b)	Voltage Class and Frequency	650V, 50HZ
c)	CT Secondary Current	1 A
d)	Class of Insulation	E or better
e)	Accuracy Class & Burden	
	For Protection	5P20, 5VA
	For Metering	Class 0.5, 5VA
f)	Instrument Security Factor for Metering CT	5

POTENTIAL TRANSFORMERS

a)	Type	Cast Resin
b)	Accuracy Class	0.5
c)	Rated Voltage Factor	1.1 continuous, 1.5 for 30 sec

d)	Class of Insulation	E or better
e)	One Minute Power Frequency Withstand Voltage	2.5 KV

HRC FUSE

a)	Voltage Class	650 Volts
b)	Rupturing Capacity	80kA (RMS) for AC circuits

CONTACTOR

a)	Type	Air break electro magnetic
b)	Utilising Category	AC3 of IS/IEC 60947 for non reversible AC4 of IS/IEC 60947 for reversible drives

14.4. Performance Guarantee

The LT switchgear along with all auxiliaries and accessories shall be capable of performing intended duties under specified conditions. The Contractor shall guarantee the reliability and performance of the individual equipment as well as of the complete system.

14.5. Design and Construction

14.5.1 Standards

The system and equipment shall be designed, built, tested and installed to the latest revisions of the following applicable standards. In the event of other standards being applicable they will be compared for specific requirement and specifically approved during detailed engineering for the purpose:

Standards	Description
IEC 60529	Degrees of protection provided by enclosures (IP Code)
IEC 60439	Low-voltage switchgear and control gear assemblies
IEC 60364	Electrical installations of buildings
IEC 60947/ IS13947	Low-voltage switchgear and control gear
IS 2705	Current Transformers
IS 3156	Voltage Transformers
IS 3043	Code of practice for earthing.
IS 3231	Electrical relays for power system protection.

14.5.2 General

The LT Switchgear shall be metal enclosed, indoor, floor mounted and free standing type.

Hinged doors and removable covers shall be provided wherever necessary to allow access to all equipment. The frame of the cubicles shall be sufficiently sturdy to ensure safe transport, mounting and operation without deformation or bulging. Natural ventilation as required shall be provided. Continuous lifting angle or lifting hooks shall be provided to facilitate the installation of cubicles.

All panel edges and cover/door edges shall be reinforced against distortion by rolling, bending or by the addition of welded reinforcement members.

The top covers of the panels should be designed such that they do not permanently bulge/bend by the weight of maintenance personnel working on it. The switchboards shall be of bolted design. The complete structures shall be rigid, self-supporting, and free from flaws, twists and bends. All cut outs shall be true in shape and devoid of sharp edges.

All switchboards shall be of dust-proof and vermin-proof construction and shall be provided with a degree of protection of IP: 5X as per IS/IEC 60947. All cut outs shall be provided with EPDM / Neoprene gaskets. Feeder Pillar with IP 55 enclosure protection meeting the technical requirement is also acceptable

All switchboards shall be of uniform height not exceeding 2450 mm. Switchboards shall be easily extendable on both sides by addition of vertical sections after removing the end covers for future expansion.

Switchboards shall be supplied with base frames made of structural steel sections, along with all necessary mounting hardware required for welding down the base frame to the foundation / steel insert plates. The base frame height shall be such that floor finishing (50mm thick) to be done by Employer after erection of the switchboards does not obstruct the movement of doors, covers, with draw able modules etc.

Sheet steel barriers shall be provided between two adjacent vertical panels running to the full height of the switchboard, except for the horizontal bus bar compartment. EPDM/Neoprene gasket shall be provided between the panel sections to avoid ingress of dust into panels.

After isolation of power and control circuit connections it shall be possible to safely carryout maintenance in a compartment with the bus bar and adjacent circuit live. Necessary shrouding arrangement shall be provided for this purpose. Wherever two breaker compartments are provided in the same vertical section insulating barriers and shrouds shall be provided in the rear cable compartment to avoid accidental touch with the live parts of one circuit when working on the other circuit.

All LT switchgear (circuit-breaker) panels shall be of single-front type.
All single-front switch boards shall be provided with single-leaf, hinged or bolted covers at the rear. The covers shall be provided with "DANGER" labels. All panel doors shall open by 90 deg or more

All LT circuit-breaker modules & contactor controlled motor modules shall be of fully draw out type having distinct 'Service' & 'Test' positions.

The equipment pertaining to a draw out type incomer or feeder module shall be mounted on a fully withdrawable chassis which can be drawn out without having to unscrew any wire/cable connection. Suitable arrangement with cradle/rollers, guides along with tool/lever operated racking in/out mechanism shall be provided for smooth and effortless movement of the chassis. For modules of size more than half the panel height, double guides shall be provided for smooth removal or insertion of module. All identical module chassis of same size shall be fully interchangeable without having to carryout any modifications.

All disconnecting contacts for power-control circuits of draw out modules shall be of robust and proven design, fully self aligning and spring-loaded. Both fixed and moving contacts shall be silver-plated and replaceable. The spring-loaded power and control draw out contacts shall be on the withdrawable chassis and same on fixed portion shall not be accepted. Detachable plug & socket type control terminals shall also be acceptable.

Individual opening in the vertical bus enclosure shall permit the entry of moving contacts from the drawout modules into vertical droppers. Each switchboard shall be provided with undrilled, removable type gland plate, which shall cover the entire cable alley. It shall be ensured that sufficient cable glanding space is available for all the cables coming in a particular section through gland plate. The gland plate shall preferably be provided in two distinct parts for easy of terminating addition cables in future. The gland plate shall be provided with gasket to ensure enclosure protection.
The minimum clearance in air between phases and between phases and earth for the entire run of horizontal and vertical busbars and bus-link connections at circuit-breaker shall be 25mm. For all other components, the clearance between "two live parts", "a live part and an earthed part", shall be at least ten (10) mm throughout. Wherever it is not possible to maintain these clearances, insulation shall be provided by sleeving or barriers. However, for busbars the clearances specified above should be maintained even when the busbars are sleeved or insulated. All connections from the busbars up to switch / fuses/MCCB shall be fully insulated and securely bolted to minimize the risk of phase to phase and phase to earth short circuits. All busbars and jumper connections shall be of high conductivity aluminium alloy / copper of adequate size

14.5.2.1 Compartments

Each cubicle shall be divided into sections, or compartments, housing the incoming, interconnecting or outgoing feeder air circuit breaker units and moulded case circuit breaker units respectively. Each ACB shall be mounted on a carriage assembly, constructed so that the unit can be removed and replaced while the buses are energized. The carriage shall have self-engaging definite position stops for disconnected, test and connected positions. All necessary means shall be provided for easy removal and handling of the unit.

(a) Busbar Compartment

A completely enclosed bus bar compartment shall be provided for the horizontal and vertical busbars. Bolted covers shall be provided for access to horizontal and vertical busbars and all joints for repair & maintenance, which shall be feasible without disturbing any feeder compartment. Auxiliary and power busbars shall be in separate compartments.

(b) Switchgear / Feeder Compartment

All equipment associated with an incomer/outgoing feeder shall be housed in a separate compartment of vertical section. The compartment shall be sheet steel enclosed on all sides with the withdrawable units in position or removed. The front of the compartment shall be provided with the hinged single leaf door with captive screws for positive closure.

(c) Cable Compartment or Cable Alley

All feeders to and from the cubicle assemblies will be cables. The assemblies shall be accessible for the cables from bottom to each feeder circuit breaker via separate cable compartment. A full-height vertical cable alley of min. 250mm width shall be provided for power and control cables. Cable alley shall have no exposed live parts and shall have no communication with busbar compartment. The termination for each module shall have its own integral glanding facility. Wherever cable alleys are not provided for distribution boards, segregated cable boxes for individual feeders shall be provided at the rear for direct termination of cables. The contractor shall furnish suitable plugs to cover the cable openings in the partition between feeder compartment and cable alley. Cable alley door shall be hinged. Solder less connectors shall be furnished for each power conductor entering the equipment. Provisions shall be made to clamp and fasten cables in the cable compartment. Terminals for cable connection will be suitable for Copper/Aluminium cables.

(d) Control Compartment

A separate compartment shall be provided for relays and other control devices associated with a circuit breaker.

14.5.2.2 Name Plates

Each feeder shall be clearly identified with suitably located nameplate(s). Nameplates shall be furnished for all instruments, control switches, etc. Each section of an assembly shall have an identifying name plate placed near the top edge.

14.5.2.3 Wiring

All secondary and control wiring shall be done with stranded copper wires, current transformer secondary leads shall not be less than 2.5 mm^2. All control wiring within the assembly housing shall be installed at the manufacturer's premises. All connections shall be made with solder less lugs. All wires and connections to remote equipment shall be wired to terminal blocks.

14.5.2.4 Bus bars

All Switchboards shall be provided with three phase & neutral busbar. Bus bar conductors shall be made of high conductivity aluminium alloy / copper of adequate size. All connections shall be in accordance with the best modern practice. A continuous bus of the same cross section as the main bus shall be furnished and connection of ample size shall be brought to each feeder compartment, for bolted connection of the feeder.

The busbars shall be adequately supported and braced to withstand the stresses due to the specified short circuit currents. Neutral busbar short circuit strength shall be same as main busbars. All busbars shall be adequately supported by non-hygroscopic, non-combustible, track-resistant and high strength sheet moulded compound or equivalent type polyester fibre glass moulded insulator. Separate supports shall be provided for each phase and neutral busbar. If a common support is provided, anti-tracking barriers shall be provided between the supports. Insulator and barriers of inflammable material such as Hylam shall not be accepted. The busbar insulators shall be supported on the main structure.

Phase arrangements shall be R-Y-B from top to bottom, from back to front and from left to right when facing the front of the equipment. All bus bars shall be clearly marked by engraved letters.

Adequate provisions must be made for the expansion and contraction of the bus bars and other bus bar connections with variation in temperature. Bus bars shall be so arranged that they can be extended in length without difficulty.

All field connections shall be bolted. The connections shall be kept as short and straight as possible. Bus bars, connections and their insulating supports shall be of approved construction, mechanically strong and shall withstand all the stresses, which may be imposed upon them under ordinary working conditions due to vibration, temperature fluctuations, short circuit or other reasonable causes.

Copper/Aluminium earth bus shall be provided at the bottom of each panel and shall extend throughout the length of each switchboard. It shall be welded/bolted to the framework of each panel and breaker earthing contact bar. Vertical earth bus shall be provided in each vertical section which shall in turn be bolted/welded to main horizontal earth bus. The earth bus shall have sufficient cross section to carry the momentary short circuit and short time fault current to earth without exceeding the allowable temperature rise.

Suitable arrangements shall be provided at each end of horizontal earth bus for bolting to earthing conductors. The horizontal earth bus shall project out of the switchboard ends and shall have predrilled holes for this connection. All joint splices to earth bus shall be made through at least two bolts, and taps by proper lug and bolt connection. All non-current carrying metal work of the switchboard shall be effectively bonded to the earth bus. Electrical conductivity of the whole switchgear enclosure framework and truck shall be maintained even after painting.

All metallic cases of relays, instruments and other panel-mounted equipment shall be connected to earth by independent stranded copper wires of size not less than 2.5 sq. mm. All the equipment mounted on the

door shall be earthed through flexible wire/braids. Insulation color code of earthing wires shall be green. Earthing wires shall be connected to terminals with suitable clamp connectors, soldering is not acceptable. Looping of earth connections which would result in loss of earth connections to other devices, when a device is removed, is not acceptable. However, looping of earth connections between equipment to provide alternative paths to earth bus is acceptable. VT and CT secondary neutral point earthing shall be at one place only, i.e. on the terminal block. Such earthing shall be made through links so that earthing of one secondary circuit shall be removed without disturbing the earthing of other circuit.

14.5.2.5 Instruments

Control switches and instruments shall be mounted on the circuit breaker compartment doors/front side of the panel.

14.5.2.6 Air Circuit Breakers

The air circuit breakers shall be designed in accordance with the recommendations of IEC Publications 60947-1 and 60947.2. All circuit breakers shall be of the draw out type, housed in individual metal-enclosed compartments. Each air circuit breaker shall be mounted on a carriage assembly with wheels running on tracks secured to the inside of the compartment. The carriage shall have self-engaging definite position stops for disconnected, test and connected position. Means shall be provided for easy removal and handling of the breakers. Suitable guides shall be provided to minimize misalignment of the breaker.

The operating handle shall be located so that the air circuit breakers can be operated without opening the compartment door.

A mechanical interlock shall prevent moving of the air circuit breaker from the connected position, while the breaker is closed, and prevent the access door being opened unless the circuit breaker is in test or withdrawn position.

The frame of the air circuit breakers shall be solidly grounded in both test and connected positions. In the test position, it shall be possible to operate the breaker and perform complete functional tests.

The air circuit breaker shall be equipped with shutters, which automatically cover live parts when the breaker is withdrawn. Provision shall be made for padlocking the circuit breaker in the disconnected and test position.

The main circuit breaker contacts shall be of the self-cleaning type, made from an arc resisting material and provided with auxiliary arcing contacts as a protection against burning during the operating of the breaker. All contacts shall be self-aligning, and shall be readily replaceable. Main and secondary disconnecting contacts shall be silver plated with springs, which will ensure high-pressure contacts. Secondary contacts shall be engaged both in connected and test position.

There shall be "SERVICE", "TEST" and "FULLY WITHDRAWN" positions for the breakers. In "Test" position the circuit breaker shall be capable of being tested for operation without energising the power circuits i.e. the power contacts shall be disconnected, while the control circuits shall

remain undisturbed. Locking facilities shall be provided so as to prevent movement of the circuit breaker from the "SERVICE", "TEST" or "FULLLY WITHDRAWN" position. Circuit Breaker rack-in and rack-out from Service to Test, Test to Isolated position, or vice-versa shall be possible only in the compartment door closed condition.

Auxiliary contacts for position indication, control, interlocks, etc., showing whether the breaker is in open, closed or tripped position and whether the operating spring is locked, shall be provided and wired to terminals. Mechanical position indicators, visible from the outside without opening the circuit breaker compartment door, shall also be provided. All circuit breakers shall be provided with "6 NO" and "6 NC" potential free auxiliary contacts. These contacts shall be in addition to those required, for internal mechanism of the breaker and should be directly operated from breaker operating mechanism. Separate limit switches, each having required numbers of contacts shall be provided in both "SERVICE" and "TEST" position of the breaker. All contacts shall be rated for making, continuously carrying and breaking 10 Amp at 240 V AC and 1 Amp (Inductive) at 220 V DC respectively.

Each air circuit breaker shall be equipped with facilities for remote operation. Each air circuit breaker unit shall be equipped with a manual/ auto selection switch, local start-stop push button and an indicator showing the position of the breaker in the control room. The air circuit breaker shall be operable with the breaker in test position. Auxiliary contactors with an alarm contact for remote indication of tripped condition shall be provided for protection of the control circuits.

Auxiliary contacts for the following remote indications of the circuit breakers shall be wired to terminal blocks:

- Main contact position,
- Test and connected /service position,
- Trip condition,
- Fault condition.

Suitable mechanical indications shall be provided on all circuit breakers to show "OPEN", "CLOSE", "SERVICE ", "TEST" AND "SPRING CHARGED" positions. Main poles of the circuit breakers shall operate simultaneously in such a way that the maximum difference between the instants of contacts touching during closing shall not exceed half a cycle of rated frequency. Closing of a circuit breaker shall not be possible unless it is in "SERVICE" position, "TEST" position or in "FULLY WITHDRAWN" position. Circuit-breaker cubicles shall be provided with safety shutters operated automatically by the movement of the circuit breaker carriage, to cover the stationary isolated contacts when the breaker is withdrawn. It shall however be possible to open the shutters intentionally against pressure for testing purposes.

Circuit breakers shall be provided with coded key/electrical interlocking devices, as per requirements. Circuit breaker shall be provided with anti-pumping feature (soft) and trip free feature, even if mechanical anti-pumping feature is provided. Mechanical tripping shall be possible by means of front mounted Red "trip" push-button. In case of electrically operated breakers these push buttons shall be shrouded to prevent

accidental operation. Complete shrouding / segregation shall be provided between incoming and outgoing bus links of breakers. In case of bus coupler breaker panels the busbar connection to and from the breaker terminals shall be segregated such that each connection can be approached and maintained independently with the other bus section live. Dummy panels if required to achieve the above feature shall be included in the scope of supply.

Power operated mechanism shall be provided with a Universal motor suitable for operation on DC Control supply. In case of DC supply motor should satisfactorily operate with voltage variation between 85% to 110% nominal control supply voltage. Motor insulation shall be class "E" or better. The motor shall be such that it requires not more than 30 seconds for fully charging the closing spring at minimum available control voltage. Once, closing springs are discharged, after one closing operation of circuit breaker, it shall automatically initiate recharging of the spring. The mechanism shall be such that as long as power is available to the motor, a continuous sequence of closing and opening operations shall be possible. After failure of power supply at least one open-close-open operation shall be possible. Provision shall be made for emergency manual charging and as soon as this manual charging handle is coupled, the motor shall automatically get mechanically decoupled.

All circuit breakers shall be provided with closing and trip coils. The closing coil shall operate correctly at all values of voltage between 85% to 110% nominal control supply voltage. The trip coil shall operate satisfactorily at all values of voltage between 70% to 110% nominal control supply voltage.. Provision for mechanical closing of the breaker only in "Test" and "WITHDRAWN" positions shall be made. Alternately, the mechanical closing facility shall be normally made inaccessible; accessibility being rendered only after deliberate removal of shrouds. The ACB Panel door shall not be possible to open in breaker closed condition. Further, the racking mechanism shall be accessible only after opening the breaker panel door.

The air circuit breakers shall be equipped with adjustable magnetic short circuit over current and instantaneous trip mechanism/ relay, with auxiliary magnetic short circuit contacts for indication of tripped condition. The protection equipment shall be interchangeable. It shall be the responsibility of the Contractor to fully coordinate the overload and short circuit tripping of the circuit breakers with the upstream and downstream circuit breakers/fuses/motor starters to provide satisfactory discrimination.

14.5.2.7 Moulded Case Circuit Breakers (MCCB)

The MCCBs shall be designed in accordance with the IEC Publications 60947.1 and 60947.2. All MCCBs shall be manually operated and shunt trip type. MCCBs of rating 63A and higher shall be of the draw out type, three pole, air break type having trip free mechanism with quick make and quick break type contacts housed in individual metal-enclosed compartments. MCCB shall have current limiting feature. MCCB of identical ratings shall be physically and electrically interchangeable. MCCBs shall be operable by means of push button switches/ handle.

Each MCCB shall be mounted on a carriage assembly with wheels running on tracks secured to the inside of the compartment. The carriage

shall have self-engaging definite position stops for disconnected and connected position. Means shall be provided for easy removal and handling of the units. ON, OFF TRIP position of MCCBs should be indicated. A mechanical interlock shall prevent moving of the MCCB from the connected position, while the breaker is closed, and prevent the access door being opened unless the breaker is in withdrawn position.

The MCCB contacts shall be of the self-cleaning type, made from an approved arc resisting material. All contacts shall be self-aligning, and shall be readily replaceable. Main and secondary disconnecting contacts shall be silver plated, with spring, which will ensure high-pressure contact. Secondary contacts shall be engaged both in connected and test position.

MCCB shall be provided with Microprocessor based inbuilt front adjustable releases (overload & short circuit) and shall have adjustable earth fault protection unit also. The protection settings shall have suitable range to achieve the required time & current settings. LED indications shall also be provided for faults, MCCB status (on/off etc).

The auxiliary contacts of the MCCB shall be fed to the digital inputs in the numerical relays of Incomer/bus coupler/motor circuit breaker feeders, for integration in to the numerical relay network.

MCCB terminals shall be shrouded and designed to receive cable lugs for cable size relevant to circuit rating. Extended cable terminal arrangement for higher size cable may also be offered. ON and OFF position of the operating handle of MCCB shall be displayed and the rotary operating handle shall be mounted on the door of the compartment housing MCCB. MCCBs being offered shall have common/interchangeable accessories for all ratings like aux. switch, shunt trip, alarm switch etc. The MCCBs shall have current discrimination up to full short circuit capacity and shall be selected as per manufacturer's discrimination table.

14.5.2.8 Contactors

Motor starter contactors shall be of air break, electromagnetic type rated for uninterrupted duty as per IS: 13947 Part-4 Section- 1. Contactors shall be double-break, non-gravity type and their main contacts shall be silver faced. The number of normally open (NO) and normally closed (NC) auxiliary contacts of a contactor shall be as per requirement. It shall, however, be not less than 2NO+2NC. Operating coil of contactors shall be of 110 V AC unless otherwise specified elsewhere. The contactor shall operate satisfactorily between 85% and 110% of the rated voltage. The contactor shall not drop out at 70% of the rated voltage but shall definitely drop out at 20% of the rated voltage. Contactors for DC drives shall have a coil voltage of 240 V DC. DC operated contactor coil shall have an economy resistor and shall be suitable for satisfactory continuous operation at 187V-242V DC/93.5V – 121V DC.

14.5.2.9 Fuses

All fuses shall be of HRC cartridge fuse link type. Screw type fuses shall not be accepted. Fuses for AC circuits shall be rated for 80kA rms (prospective) breaking capacity at 415V AC and for DC circuits, 20kA rms breaking capacity at 240V DC.

Fuse shall have visible operation indicators. Insulating barriers shall be provided between individual power fuses.

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

Fuse ratings for motor feeders shall be coordinated by the Bidder to achieve class-II protection coordination and also to match the motor characteristics. Switch rating shall in no case be less than the fuse rating.

The Neutral links shall be mounted on fuse carriers which shall be mounted on fuse bases.

14.5.2.10 Internal Wiring

All switchboards shall be supplied completely wired internally up to the terminals, ready to receive external cables. All the inter cubicle and inter panel wiring and connections between panels of same switchboard including all bus wiring for AC and DC supplies shall be provided.

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

14.5.2.11 Current Transformers

The current transformer shall be single phase single core inductive type. It shall be mounted within the cubicles and shall comply with the requirements of relevant IEC 60044-1.

Air circuit breakers shall have single core CTs of suitable rating (based on capacity of breaker) for protection of 5P20 class. The secondary windings of all current transformers shall be grounded at one point only and means shall be provided to facilitate the secondary windings to be short-circuited. The burden rating of all current transformers shall not be less than 200% of the overall computed burden of apparatuses connected to each transformer.

14.5.2.12 Potential Transformers

Required no. of potential transformer shall be provided for metering and interlock. The Contractor shall use single-phase 240V supply available in switchgear for metering and indication.

14.5.2.13 Metering

Each incoming feeder containing current transformers and voltage transformer shall have energy meter/ Multifunction meter, ampere meters and ammeter selector switches, voltmeters and voltmeter switches located in the respective feeder compartment doors. All metering circuits shall be terminated in terminal blocks for remote metering purposes.

14.5.2.14 Interlocks

The following interlocks are foreseen and shall be completed and developed in conjunction with the control system:

- In all operating modes the sectionalising circuit breaker shall normally be open and shall be closed only in case of loss of one Bus-Section power supply,
- It shall be possible to insert/withdraw the breaker only in open position,
- It shall be possible to lock the circuit breaker closing mechanism in open position.

14.6. Drawings, Documents and Design Calculations

14.6.1. Drawings and Documents

The Contractor shall submit all the drawings and documents in accordance with requirements stipulated in section 2 "Technical Documents" of "General Technical Specification (GTS)".

14.6.2. Design Calculation

The Contractor shall submit the design calculation in accordance to Clause 2.4 of "General Technical Specification (GTS)" covering at least the following, for review / acceptance.

- Fault level at each board taken in consideration for their design,
- Burden on CTs,
- Thermal ability to withstand short circuit.

14.7. Delivery, Installation and Commissioning

The Contractor shall follow the requirements of Delivery, Installation and commissioning elaborated in clause "Delivery, Installation and commissioning" of General Technical Requirements."

14.8. Spare Parts

In accordance to clause 1.8 "Spare Parts" of "Section 1 - General Technical Requirements". Specified spare parts to be supplied under this section are as follows:

S. No.	Description	Quantity
1	Air Circuit Breaker and/ or MCCB in incoming feeders	01 no. of each used type
2	MCCB (If applicable) and MCBs in outgoing feeders	01 nos. of each used type
3	Current Transformer	01 no. of each used type
4	O/C, E/F & U/V Relays	01 no. each used type

14.9. Deleted

14.10. Quality Assurance and Testing

The Contractor shall follow the quality assurance and testing requirements as per approved “Quality assurance and Testing Specifications (QTS)”.

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15. ILLUMINATION SYSTEM

15.1 Scope of Work

Scope of work under this section covers the provision of labour, tools, plants, materials and performance of work necessary for the design, manufacture, quality assurance, quality control, shop assembly, shop testing, delivery at site, site storage and preservation, installation, commissioning, performance testing, acceptance testing, handing over to Employer and guarantee for two years of illumination system for Solar Photovoltaic (SPV) Power Plant and as per the specifications hereunder, complete with all auxiliaries, accessories, spare parts and warranting a trouble free safe operation of the installation.

The scope of work shall be a comprehensive functional system covering all supply and services including but not be limited to following:

15.1.1 Normal Lighting System

1. Normal indoor and outdoor lighting system for Main Control Room, Inverter Rooms/ shelters, Security Room(s), approach roads, peripheral roads etc. in plant shall be through 415 V, AC systems, comprising of following major components:
   i. Lighting Cabinets,
   ii. All Energy Efficient LED type lighting system for indoor and outdoor, including the light fittings, lighting facia/panels, warning/direction sign boards. For hazardous areas, conventional type luminaires shall be used. In false ceiling area LED luminaires shall be recessed mounting type & in non-false ceiling area the LED luminaires shall be surface mounting type.
   iii. Control Points, including:
      a Push-buttons or switches,
      b Dimmers, smart switches/sensors,
      c Indicator lights on the main control panel indicating on-off circuits.
2. Outdoor illumination along all peripheral roads and all approach roads to main control room, inverter room/ shelters and other facilities of plant shall be through energy efficient LED type lighting system and the same shall be adequately illuminated.

   All lighting fixtures and control gears including lighting panels shall be powder coated, weather proof and of minimum IP 55 deg of protection.

   All outdoor lighting system shall be automatically controlled by synchronous timer or photocell. Provision to bypass the timer or photocell shall be provided in the panel.

3. All lighting fixtures and accessories shall be designed for continuous operation for its life under atmospheric conditions existing at site.

4. Exhaust fans shall also be provided in toilets, battery room, etc

All cabling and wiring including conduits, racks, ducts, channels or any other media of cable runs and associated accessories / fixtures/ fasteners for normal lighting system.

LED Luminaires:

The individual lamp wattage for LED shall be min 3 watt for outdoor type luminaires. However for indoor type luminaires fractional wattage LEDs are also acceptable.

The LED chip efficacy shall be min 120 Lm/W. The luminaire efficacy shall be not less than 70 Lm/W. Suitable heat sink shall be designed & shall be provided in the luminaire. The LED used in the luminaire shall have Colour rendering Index (CRI) of min 70 and 80 for outdoor and indoor luminaries respectively.

Colour designation of LED shall be “cool day light” (min 5700K) type for indoor type LED luminaries. Further for outdoor type luminaries, the colour designation shall be 5000K, except for well glass type LED luminaries, where the colour designation shall be 4000K.The LED luminaries shall have minimum life of 25,000 burning hours with 80% of lumen maintenance at the end of the life.

The beam angle for LED chip shall be 120 deg. However for highbay & flood light type outdoor luminaries the LED chip with suitable beam angle shall be used to deliver better lumen output. The maximum junction temperature of LED shall be 90 degree C and further the lumen maintenance at this temperature shall be min 90%.The THD of LED luminaires shall be less than 20%.

Further the EMC shall be as per IS 14700. The PF of the luminaire shall not less than 0.9.The marking on luminaire & safety requirements of luminaire shall as per relevant IS standards. Suitable heat sink with proper thermal management shall be designed & provided in the luminaire.

The entire housing shall be dust & water proof protection as per IS 12063.LED drivers shall have control & protection of precision current control, open circuit, short circuit, over temperature and over load. The connecting wires used inside the system, shall be low smoke halogen free, fire retardant PTFE cable & fuse protection shall be provided in input side specifically for LED luminaires.

15.1.2 Emergency Lighting System

Emergency lighting system shall be used for indoor/ outdoor applications such as Main control room, Inverter Rooms/locations, Security Room(s), main gate etc. It will comprise of:

i. Emergency lighting boards,

ii. Lighting equipment, including the light fittings, switch boards etc.

iii. All cabling and wiring including conduits, racks, ducts, channels or any other media of cable runs and associated accessories / fixtures/ fasteners for emergency lighting system.

15.1.3 Miscellaneous Items

Two numbers assorted portable aluminium ladder for maintenance of plant.

15.2 Specific Parameters and Layout Conditions

15.2.1 Layout and General Arrangement

Normal AC Lighting System of 415V, 3 Phase, 5 wire, will be fed from Lighting Distribution Boards (LDBs) which in turn will be fed from the 415V, Main AC Distribution Board.

Emergency AC lighting fixtures shall be normally "ON" along with the normal AC system. These will be fed from Emergency Lighting Distribution Boards (ELDB'S) which in turn will be fed from the UPS / Inverters DB.

15.3 Rating and Functional Characteristics

15.3.1 Service Voltages

1.	Normal Lighting System	Three-phase, five wire, 415/240V, 50Hz
2.	Emergency Lighting System	Three-phase, five wire, 415/240V, 50Hz
3.	Outdoor Lighting	Three-phase, five wire, 415/240V, 50Hz
4.	AC Socket outlets Single- Phase	Single-phase, three pins, 240V, 50Hz
5.	Power Socket outlets Three-Phase	Three-phase, five pins, 415/240V, 50Hz

15.3.2 Lux Levels and Quality of Direct Glare Limitation

The nominal illumination level for lighting, measured at the height of a worktable (0.9 m) shall have an average lux value as mentioned below:

S.No.	Location	Average Lux Level	Quality Class of Direct Glare Limitation
1	Main Control Room, Offices, Conference Hall etc.	300	1
2	Inverter Room(s)	150	2
3	Store Room, Switchgear Room	200	2
4	Switchyard (Not applicable)	20 (General) 50 (On Strategic Equipment)	---
5	Security Room(s)	50	1

Any other area not specified above, however wherein illumination is envisaged shall have the average lux level as decided during the detailed engineering stage.

15.4 Performance Guarantee

The illumination system along with all auxiliaries and accessories shall be

capable of performing intended duties under specified conditions. The Contractor shall guarantee the reliability and performance of the individual equipment as well as of the complete system. The Contractor shall guarantee the lux levels in various areas as specified above.

15.5 Design and Construction

15.5.1 Standards

The system and equipment shall be designed, built, tested and installed to the latest revisions of the following applicable standards. In the event of other standards being applicable they will be compared for specific requirement and specifically approved during detailed engineering for the purpose:

S.No.	Standards	Description
1.	IEC 60598	Luminaries
2.	IEC 60309	Plugs, socket outlets and couplers for industrial requirements
3.	IS 6665	Code of practice for industrial lighting
4.	IS 10322	Specification for Luminaries
5.	IS 3646	Code of practice for interior illumination

15.5.2 Power Supply Network

Control rooms, offices, facilities, utilities, Inverter Rooms/ Shelters shall be equipped with power outlet circuits as agreed during detailed engineering. Necessary breakers/switches, protective and indicating devices shall be provided for each socket/cubicle.

15.5.2.1. Portable Socket Cubicles

Portable socket cubicles mounted on wheel trolleys with suitable length (not less than 50 meter) cable connected to the cubicle, and equipped with a male connector at the other end shall be provided at 2 locations of inverter room/ shelters & 01 no in Main Control Room to extend the maintenance power supply at required location by connecting these cubicles to fixed sockets. Provision for connecting this portable cubicle should be available in each inverter room/ location & control room. Cubicle shall include:

i. A protection circuit breaker,

ii. An indicator light to show “On” and “Off” status,

iii. Three (3) nos. 32 A, 240 V three (3) pin socket,

15.5.3 Distribution Boards

The boards shall be of wall/column mounted/panel type and shall be suitably located. The boards shall be made of sheet steel not less than 14SWG and provided with front hinged cover for further enabling the board to be unscrewed for inspection of wiring in the board.

Boards shall be waterproof and shall be provided with glands or adapters to receive a screwed conduit. The Distribution Board should standard phase segregated type at control room and all inverter room.

15.5.4 Switchboards

The switchboards shall be of heavy duty and modular type and shall be located 1.5 meters above the floors. All the switches shall be of piano type and shall have silver cadmium contacts. Multiple plug power sockets shall be capable of taking at least one 3-pin plug and one 2-pin plug simultaneously. Each type of power socket shall have elliptical spring loaded contacts.

15.5.5 Cables

The cables shall be of at least 1100V grade, PVC insulated. All single core cables shall be of copper flexible conductor. Cables from distribution boards to switch boards and to light fixtures, single phase AC sockets shall be of copper flexible conductor. Minimum size of copper conductor for single core cable shall be 2.5 mm^2.

The insulating material of cable shall not deteriorate with age or due to the voltage stresses etc. Each cable coil shall be accompanied by the manufacturer's test giving the results of the insulation test.

The wiring shall be done in looping back system. No joints shall be made at intermediate points in the given length of the cables.

15.5.6 Wiring

It is proposed to carry out surface wiring for illumination circuits in equipment areas/floors. Concealed/recessed wiring shall be done in control room, offices, reception and any other area requiring aesthetic appeal.

Conduits and/or wire ways shall be used for wiring between fixtures and control points. Separate conduits/wire ways shall be used for light, power and communication points.

The cables shall be properly terminated by using lugs or other approved arrangement.

15.5.7 Lighting Accessories

Each socket outlet for lighting and power shall be controlled by a switch, which shall be on the live side on the line. The socket outlets shall be of 3 pin type to provide earth connection to each outlet.

The power socket outlets shall be 16A / 32A single-phase as per requirement to be approved by the Employer. Multi plugs of 16A and 32A shall be of metal clad type.

Suitable number of 63A, 3ph, 415V AC industrial receptacles shall be provided for welding purposes at one location.

15.5.8 Conduiting

Conduits shall be of heavy duty type, hot dip galvanised steel conforming to IS 9537 or fibre glass reinforced epoxy conduits which have compressive and impact strength that of galvanised conduits.

The conduits shall be supplied in random lengths of 4 m to 6 m or as finalised/decided during detailed engineering.

All necessary bends in the system shall be done by bending of conduits or by inserting suitable solid or inspection type normal boards, elbows or similar fittings whichever is more suitable.

These conduits shall be concealed in the wall/floor/roof. However, in pre engineered rooms can be fixed on surface. Anchor fasteners shall be used for fixing of conduits, light fixtures etc. wherever required. Suitable inspection boxes shall be provided to permit inspection and to facilitate removal of wires if necessary.

15.5.9 Lighting Poles

The Street Light system and peripheral lighting shall be designed generally in line with design guidelines. Height of the poles should be chosen so as not to affect working of Solar panels. The poles shall be hot-dip galvanized as per relevant IS2629/ IS2633/ IS4759. The average coating thickness of galvanizing shall be min. 70 micron.

The System shall be capable of withstanding the appropriate wind load etc as per IS 875 considering prevailing soil/ site condition considering all accessories mounting on pole.

The street light poles shall have loop in loop out arrangement for cable entry and light fixture / wiring protected with suitably rated MCB. The luminaries used shall be minimum 30 W at a minimum pole height of 3.5 m with 35 m inter-pole spacing for peripheral roads and 50 m for all approach road and internal roads etc respectively.

Bidder shall provide 20A industrial socket at each 100 meter distance interval at the street light pole.
Hot dipped Galvanized with 80 mm thickness hexagonal/Octagonal lighting pole with inbuilt JB shall also be acceptable.

15.5.10 Earthing

The continuous earth shall be run for all the 3 pin sockets.
The neutral will be earthed at station transformer and the three phase Five wires distribution system shall be connected to the station earthing system at two or more places.

15.6 Drawings, Documents and Design Calculations

15.6.1 Design Memorandum

The Contractor shall prepare and submit to the Employer a “Design Memorandum” of the proposed equipment/system fulfilling the contract specification/requirement given in respective section for approval prior to

submission of any drawings and documents. The memorandum shall include the design philosophy, methodology, system description, input parameters for design, standard and codes, design and selection criteria, equipment data, material specification, major technical features, basic arrangement/ layout etc. Design memorandum of all the equipment / system shall be prepared and first draft shall be submitted in advance.

15.6.2 Drawings and Documents

The Contractor shall submit all the drawings and documents in accordance with requirements. These drawings and documents shall include at least the following:

i) Outline, general arrangement and layout plan for illumination system,
ii) Cable and conduit routing diagram,
iii) Wiring and termination drawings,
iv) Type of luminaries, fittings, power sockets, switches etc.,
v) Drawings for distribution boards, control points etc.,
vi) Lighting mast, lighting facia/panels details.

15.6.3 Design Calculation

The Contractor shall submit the design calculation covering at least the following, for review / acceptance.

i) Calculations for the lux levels of the different areas with respect to installation plan,
ii) Cable and conduit sizing.

15.7 Delivery, Installation and Commissioning

The Contractor shall follow the requirements of Delivery, Installation and commissioning elaborated in clause 1.7 “Delivery, Installation and commissioning” of “Section 1 - General Technical Requirements.”

15.8 Deleted

15.9 Deleted

15.10 Quality Assurance and Testing

The Contractor shall follow the quality assurance and testing requirements as per approved “Quality assurance and Testing Specifications (QTS)”.

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16 GROUNDING SYSTEM

16.1 Scope of Work

Scope of work under this section covers the provision of labour, tools, plants, materials and performance of work necessary for the design, manufacture, quality assurance, quality control, shop assembly, shop testing, delivery at site, site storage and preservation, installation, commissioning, performance testing, acceptance testing, handing over to employer and guarantee for two years of the complete grounding system and lightning protection for Solar Photovoltaic (SPV) Power Plant and as per the specifications hereunder, complete with all auxiliaries, accessories, spare parts and warranting a trouble free safe operation of the installation.

The scope of work shall be a comprehensive functional system complete in every respect including but not be limited to following:-

16.1.1 Grounding and Lightning Protection System

The intent of scope is to supply, install and supervise complete grounding and lightening protection system for SPV Plant including Main Control Room, Inverter room/ Inverter Shelter/ enclosure, HT/LT Switchgear room/ shelter and similar housing, PV module area and adjoining functional areas. The erection of grounding system shall have to be done as per the standard and the same shall be carried out with respect to the actual progress of civil works.

Over-ground Earthing Network

The over-ground earthing network shall consist of suitably spaced meshed grid embedded in

i) Main Control Room

ii) Transformer area

iii) Inverter Room area

iv) Areas where earth fault current is anticipated

v) Each array structure of the PV yard shall be grounded properly as per IS 3043 - 1987 & IEEE 80 and as per the specification mentioned elsewhere in this chapter.

Earthing for PV Array, Lightning Protection System and Other Components

vi) Lightning protection system shall be in strict accordance with IS: 2309 / IEC 62305 /equivalent IEC Standard (Protection against Lightening) & NFC 17-102 (Lightning protection with early streamer air termination rod)

vii) Lightning system shall comprise of air terminations, down conductors, test links, earth electrode etc.

viii) Each string/ array and MMS of the plant shall be grounded properly. The array structures are to be connected to earth pits as per IS standards. Necessary provision shall be made for bolted

isolating joints of each earthing pit for periodic checking of earth resistance.

ix) The Lightning Conductors shall be made as per Indian Standard: 2309 /equivalent IEC Standard, in order to protect the entire Array Yard from Lightning stroke. The drawings with data calculation sheet for the components and system shall be approved from the employer

x) Necessary concrete foundation or any other arrangement for holding the lightning conductor in position is to be made after giving due consideration to shadow on PV array, maximum wind speed and maintenance requirement at site in future.

16.1.2 Miscellaneous Components and Auxiliary System

i) Interconnection of all over-ground meshed grid embedded earthing network for reducing the touch and step potential to tolerable limits as well as serve as collectors for fault current from main equipment.

ii) Embedded grounding points connected to over-ground meshed grid at required locations for earthing of equipment.

iii) Connections of all steel structures and metal parts to embedded earthing network.

iv) An interconnected above ground / above floor main earthing network of galvanized iron flats wherever needed for earthing of machinery, equipment and the other parts.

v) Flexible copper braided connections for connection of ground points of equipment to grounding network.

vi) Clamps, sheaths, terminals and other miscellaneous items for making ground connections

Any other item(s) not mentioned specifically but necessary for the satisfactory completion of scope of work defined above, as per accepted standard(s) / best international practices.

16.2 Specific Parameters and Layout Conditions

16.2.1 Layout and General Arrangement

The Contractor shall design and construct the grounding system for protection of persons and material to allow a safe service and maintenance work on the installations.

The earthing system shall be constructed to comply with the requirements of the applicable standards and connected equipment. The grounding system shall be designed to avoid dangerous touch and step voltage.

More specifically and independent of the regulation and standards, the earthing system shall provide:

i) Adequate protection of personnel against dangerous voltages, currents and arcs,

ii) Low earthing impedance for the transformer neutrals.

iii) The fault currents shall flow through the earthing system,

iv) Limiting the induced capacitive transformed voltages on electronic cables, circuits, panels and other equipment to low voltage, weak current.

16.3 Rating

Fault current level for PV Plant may be suitably taken as per system requirement in line with relevant standards. The Contractor shall submit full detailed calculation for fault level and earthing system design for approval.

Contractor shall measure the resistivity values in plant area and furnish the same for acceptance before designing the grounding system.

16.4 Performance Guarantee

The grounding system along with all auxiliaries and accessories shall be capable of performing intended duties under specified conditions. The Contractor shall guarantee the reliability and performance of the individual equipment as well as of the complete system.

The equivalent resistance of the earth network shall be less than 1 ohm. Individual pit as well as grid earth resistance value alongwith date of measurement shall be displayed on each earth pit as per norms.

16.5 Design and Construction

16.5.1 Standards

The system and equipment shall be designed, built, tested and installed to the latest revisions of the following applicable standards. In the event of other standards being applicable they will be compared for specific requirement and specifically approved during detailed engineering for the purpose:

S.No.	Standard	Description
1.	IEEE 80-2000	Guide for safety in AC substation grounding
2.	IS 3043	Code of practice for earthing
3	IS 3034	Electrical generating station-code of practise
4.	IS 2309	Protection of Buildings and Allied Structures Against Lightning
5.	IEEE: 142	Grounding of Industrial & commercial power systems
6.	IS: 13947	Degree of protection provided by enclosures for low voltage switchgear and control gear
7.	IS: 802	Code of practice for the use of Structural Steel in Overhead Transmission Line Towers
8.	IS: 2629	Recommended practice for hot dip galvanizing of iron & steel
9.	IS: 2633	Method for testing uniformity of coating on zinc coated articles

S.No.	Standard	Description
10.	IS: 513	Cold rolled low carbon steel sheets and strips
11.	IS: 3063	Fasteners single coil rectangular section spring washers
12.	IS: 6745	Methods for determination of mass of zinc coating on zinc coated iron & steel articles
13.	IS: 4736	Hot-dip Zinc coating for MS Tubes
14.	IS: 458	Precast Concrete Pipes (with and without Reinforcement)
15.		Indian Electricity Act
16.		Indian Electricity Rules
17		CEA regulations for electrical safety-2010
18.	NF C 17-102	Lightning Protection with Early Streamer Air Termination Rod
19	IEC 625617	Requirements for earthing enhancing compounds
20	IS 2062	Hot rolled medium and high tensile structural steel — specification

The earthing system includes earth electrode, installation of earth electrode in suitable pit size, construction of earth pit with cover for the installation, connection of earth electrode with equipotential earth bus and connection of equipment to equipotential earth bus as per the relevant standard.

Earth Electrode

The earth electrode is in direct contact with the ground provides means for conducting earth current with ground. Earth Electrode material should have good electrical conductivity and mechanical strength and should not corrode in wide variety of soil conditions. For an effective earthing system, following type of vertical earth electrodes can be used.

I. MS Rods

Hot rolled, Medium or High Tensile Steel Rod as per IS 2062 of length not less than 3000 mm. and diameter of 40 mm.

II. Copper Bonded Rods

High tensile-low carbon steel rod having diameter not less than 14/17 mm of Length 3000 mm to be selected based on earth fault current. The Rod shall comply with requirements of BS 4360 Grade 43A or EN10025:2-004 S275JR molecularly bonded by 99.99% pure high conductivity copper on outer surface with copper coating thickness 250 micron or more in conformity to UL-467. Its surface shall be clean, free from mechanical defect and any visible oxide layer or foreign material.

Earthing Enhancement Compound

A low resistance earth electrode system is important to provide a low impedance path for the better dissipation of lightning/fault currents, and to

protect personnel and equipment by minimizing and equalizing voltage potential differences. Earthing (ground) enhancement materials shall be used to improve the ground electrode resistance. Earth enhancement material shall be a superior conductive material which improves earthing effectiveness, especially in areas of poor conductivity (rocky ground, areas of moisture variation, sandy soils etc.). It shall be tested and should conform to the requirements of IEC 62561-7. It shall have the following characteristics:-

a) High conductivity, improves earth's absorbing power and humidity retention capability, non-corrosive in nature having low water solubility but highly hygroscopic.

b) Carbon based with min 95% of fixed carbon content premixed with corrosion resistant cement to have set properties. Cement shall not mix separately & shall not have Bentonite.

c) Resistivity of less than 0.2 ohms -meter.

d) It shall not depend on the continuous presence of water to maintain its conductivity and shall be permanent & maintenance free and in its "set form", maintains constant earth resistance with time.

e) It shall not dissolve, decompose or leach out with time and shall be environmental friendly, suitable for soils of different resistivity and any kind of earth electrode.

The Earth enhancement material shall be supplied in sealed, moisture proof bags, marked with Manufacturer's name or trade name, quantity etc. The minimum quantity of earth enhancement compound to be used with each earth-pit shall be 25 Kg.

Earthing Conductor

Earthing conductor is the conductor for buried below the ground at the depth of 600 mm connecting earth pits to make interconnection of earth pit. To interconnect earth pits, following type of conductor can be used. Application of specific conductor and its size has been mentioned in relevant clause:

I. Galvanised Steel Flat (GS) Flat

GS/GI Flat (Strip) conductor shall comply to IS 2026 with Galvanization of 85 Micron as per IS. Material shall be clean and free form mechanical defects.

II. Copper Clad Steel (CCS) Earthing Conductor

The Copper Bonded Steel Grounding Conductor shall be made of steel with the coating of 99.99% pure copper complying to ASTM B 869-96 and ASTM B 452-93 standards. Each strand of CCS shall have continuous, uniform coating and the conductor surface shall be smooth and free from mechanical defects.

III. MS Rod

Hot rolled, Medium or High Tensile Steel Rod as per IS 2062 of length not less than 3000 mm and diameter of 40 mm.

General Technical and Installation Requirement of Earthing

Careful consideration should be given to installing an earthing system that meet or exceed statutory requirements. Contractor shall select certified product and ensure good workmanship for installation for satisfactory

performance to fulfill the designed parameters all the times. Following care shall be taken while installation of earthing.

a) Metallic frame of all electrical equipment shall be earthed by two separate and distinct connections to earthing system, each of 100% capacity, Crane rails, tracks, metal pipes and conduits shall also be effectively earthed at two points.

b) Steel RCC columns, metallic stairs, and rails etc. of the building housing electrical equipment shall be connected to the nearby earthing grid conductor by one earthing ensured by bonding the different sections of hand rails and metallic stairs.

c) Metallic sheaths/screens, and armour of multi-core cables shall be earthed at both ends. Metallic Sheaths and armour of single core cables shall be earthed at switchgear end only unless otherwise approved.

d) Metallic column for Inverter/Switchgear shelter/electrical house shall be earthed with two distinct connections at minimum two columns. All walls cladding section shall be earthed at minimum two locations with flexible copper cable of not less than 50 sq. mm.

e) Every alternate post of the switchyard fence shall be connected to earthing grid by one GS flat and gates by flexible lead to the earthed post. Portable tools, appliances and welding equipment shall be earthed by flexible insulated cable.

f) Each continuous laid lengths of cable tray shall be earthed at minimum two places by G.S. flats to earthing system, the distance between earthing points shall not exceed 30 meter. Wherever earth mat is not available, necessary connections shall be done by driving an earth electrode in the ground.

g) Neutral connections and metallic conduits/pipes shall not be used for the equipment earthing.

h) Lightning protection system down conductors shall not be connected to other earthing conductors above the ground level.

i) Connections between earth leads and equipment shall normally be of bolted type. Contact surfaces shall be thoroughly cleaned before connections. Equipment bolted connections after being tested and checked shall be painted with anti corrosive paint/compound.

j) Suitable earth risers as approved shall be provided above finished floor/ground level, if the equipment is not available at the time of laying of main earth conductor.

k) Connections between equipment earthing leads and between main earthing conductors shall be of welded type. For rust protection the welds should be treated with red lead compound and afterwards thickly coated with bitumen compound. All welded connections shall be made by electric arc welding.

l) Resistance of the joint shall not be more than the resistance of the equivalent length of conductors.

m) Earthing conductors buried in ground shall be laid minimum 600 mm below grade level unless otherwise decided during detail engineering. Back filling material to be placed over buried conductors shall be free from stones and harmful mixtures. Back filling shall be placed in

layers of 150 mm. The backfill Material shall be carbon based and of low resistance, non corrosive, highly conductive material that improves grounding effectiveness.

n) Earthing conductors embedded in the concrete floor of the building shall have approximately 50 mm concrete cover.

o) Minimum earth coverage of 300 mm shall be provided between earth conductor and the bottom of trench/foundation/underground pipes at crossings.

p) Earthing conductors crossings the road can be installed in pipes. Wherever earthing conductor crosses or runs at less than 300 mm distance along metallic structures such as gas, water, steam pipe lines, steel reinforcement in concrete, it shall be bonded to the same.

q) Earthing conductors along their run on columns, walls, etc. shall be supported by suitable welding / cleating at interval of 1000mm and 750mm respectively.

r) Earth pit shall be constructed as per IS:3043. Electrodes shall be embedded below permanent moisture level.

s) Minimum spacing between electrodes shall be 600mm. Earth pits shall be treated with salt and charcoal if average resistance of soil is more than 20 ohm meter.

t) Earthing conductor shall be buried 2000mm outside the switchyard fence. Every post of the fence and gates shall be connected to earthing loop by one lead.

u) Periphery fencing wherever provided shall be earthed at every 100 meter interval with 25X3 GS flat connected with DC or AC side nearest buried earthing conductor.

v) Earth resistance at earth terminations shall be measured and recorded. All equipment required for testing shall be furnished by contractor.

w) Contractor shall obtain all necessary statutory approvals for the earthing system before charging of the plant and electrical equipment.

Based on the soil resistivity data of the site, contractor may also provide special earthing arrangement like chemical earthing etc in order to meet the earthing resistance requirements. For chemical earthing, compound shall have pH between 6 to 8. On completion of installation continuity of earth conductors and efficiency of all bonds and joints shall be checked.

16.5.2 Design Consideration

The Contractor shall make the design and the calculation of the whole grounding system. However, Earthing system shall be in strict accordance with IS: 3043 and Indian Electricity Rules/Acts.

Contractor shall obtain all necessary statutory approvals for the system.

The earthing system shall be such structured that breaking of a conductor at any point in the network shall not disconnect any part of the network from the earth.

Following are the minimum requirement for design of the system:

i) The earthing conductors/risers shall be as per IEEE/IS and approved calculation.

ii) The mesh spacing of the ground mats shall be as per IEEE/IS and approved calculation.

iii) Earth earthing conductor in ground or above ground should be interconnected as per IS/IEEE.

iv) Surge protection shall be provided on the DC side, data lines and the AC side of the solar plant

AC EARTHING SYSTEMS:

This section outlines the requirements of protective and functional earthing system to discharge AC fault current to earth and provide equipotential bonding for Transformer, HT, MV and LT Switchgear Panel and other similar electrical equipments, Transformer neutral and shield.

The Contractor shall furnish the detailed design and calculations as per IEEE 80/IS 3043 for Employer's approval for equipment earthing.

Earthing System Requirement for AC Earthing:

Conductors above ground level and in built up trenches	Galvanised Steel
Conductors buried in earth	Mild Steel rod of 40mm dia / GS Flat
Earth Electrodes	Mild Steel Rod of diameter 40mm or Copper Bonded Steel Rod of diameter not less than 17 mm
Life Expectancy	25 years
Fault Level	As per system requirement
Min. Steel Corrosion	As per IS 3043
Soil Resistivity	Actual as per site condition
Conductor Joints	By electric arc welding, with resistance of joint not more than that of the conductor. Welds to be treated with red lead for rust protection and then coated with bitumen compound for corrosion protection.
Depth of burial of main earth conductor	600mm below grade level and where it crosses trenches, pipes, ducts, tunnels, rail tracks, etc., it shall be at least 300mm below them.

The sizes of earthing conductors for various electrical equipments shall be as below:

S. No.	Equipment	Earth Conductor buried in Earth	Earth Conductor above ground

			level and built up trenches
1	Switchyard/Outdoor Substation	40 mm dia. MS rod	65 X 8 mm GS flat
2	33kv/11kV/415 V Switchgear	65 X 8 mm GS flat	65 X 8 mm GS flat
3	415 V MCC/ Distribution Boards/ Transformers	65 X 8 mm GS flat	50 X 6 mm GS flat
4	LT Motors above 125 KW	65 X 8 mm GS flat	50 X 6 mm GS flat
5	LT Motors 25 KW to 125 KW	65 X 8 mm GS flat	25 X 6 mm GS flat
6	LT Motors 1 KW to 25 KW	65 X 8 mm GS flat	25 X 3 mm GS flat
7	Fractional Horse Power Motor	65 X 8 mm GS flat	8 SWG GI wire
8	Control Panel & Control Desk	65 X 8 mm GS flat	25 X 3 mm GS flat or 25 sq mm Cu cable
9	Push Button station junction box	65 X 8 mm GS flat	8 SWG GI wire
10	Columns, structures, cable trays and bus duct enclosure	65 X 8 mm GS flat	50 X 6 mm GS flat
11	Crane, rails, rail tracks & other non-current carrying metal parts	65 X 8 mm GS flat	25 X 6 mm GS flat

Earth Pit for Earthing of Inverter Transformer Shield:

Number of isolated shield earth pit shall be minimum two for each transformer. Shield earth pit shall be connected to inverter transformer shield bushing conductor with copper flat. Size of Cu flat shall be decided during detailed engineering but shall not be less than 25 X6 Cu flat. Contractor has to comply with the guidelines of Inverter Transformer/Inverter manufactures (if any) for shield earthing.

Functional Earthing of Electronic components such as SCADA/other Electronic devices:

For functional earthing of electronic component such as SCADA, contractor shall provide 1 no. (Min) isolated earth electrode near to the

equipment connected with 2 run of copper cable of size not less than 25 sq mm. Contractor shall comply to the recommendation of OEM (Original Equipment Manufacturer) for electronic earthing.

No. and location of electronic earth pit shall be decided during detailed engineering however minimum no. of electronic earth pit shall be equal to the total nos. of inverter rooms/ shelters, pooling switchgear/s and/or Main control room. DC side of each inverter shall be earthed to distinct earth pit through adequate size conductor as per IS 3043-1987.The size of conductor shall be as per the maximum fault current of DC.

Inverter functional earthing (Negative earthing, Anti PID Earthing) shall be carried out as per guideline of OEM. Contractor shall submit complete detail of such earthing from OEM and implement the earthing accordingly

Contractor shall have to take owner's approval for connecting solar array earth mat with any other earth mat/earth grid of the solar PV plant.

Earth pit shall be constructed as per IS: 3043. Electrodes shall be embedded below permanent moisture level. Minimum spacing between electrodes shall be 600 mm. Earth pits shall be treated with salt and charcoal if average resistance of soil is more than 20 ohm meter.

On completion of installation, continuity of earth conductors and efficiency of all bonds and joints shall be checked. Earth resistance at earth terminations shall be measured and recorded. All equipment required for testing shall be furnished by contractor.

~~**Outdoor Switchyard**~~

~~For outdoor switchyard, earthing system network/ earth mat shall be interconnected mesh of mild steel rods buried in ground. For other areas in the solar plant such as transformer yard, switchgear room the earthing system shall consist of minimum two parallel conductors interconnected together. The contractor shall furnish the detailed design and calculations for employer's approval for equipment earthing. Contractor shall also obtain all necessary statutory approvals for the system (if required).~~

~~The earth conductors shall be free from pitting, laminations, rust, scale and other electrical, mechanical defects~~

SOLAR ARRAY (DC) EARTHING:

This section outlines the earthing requirement for discharging DC fault current to earth of Solar PV plant and provides equipotential bonding for Module Mounting Structure (MMS), SCB Mounting structure, Module Frames etc.

Each MMS, SPV Module frame, mounting arrangement for String Combiner Boxes, Metallic Junction Boxes, Metal frames/Panel, Metallic Pipes of the solar array shall be effectively earthed by two separate and distinct connections to earthing system.

Earthing system for solar array shall consist of interconnected earth pits electrodes connected by 25X6 GS flat (Min.) or Copper Clad Steel (CCS) earthing Conductor of size not less than 120 SQ MM laid at the depth of 600 MM below the ground.

Minimum size of riser conductor to connect the structures to buried earthing conductor and structure to structure in the solar farm shall be 25X3 GS Flat or CCS of Minimum 70 SQ MM size.

Equipment and structure in the solar farm shall be earthed in compliance to the IS: 3043 (Code of Practice for Earthing) and Indian Electricity Rules/Acts.

System Requirement for the Solar Array Earthing:

Life Expectancy	25 Years
System Fault Level	5 KA for 1 Sec
Soil Resistivity	Actual as per site conditions
Min. Steel Corrosion	As per IS 3043
Earth Conductor Joints	By electric arc welding, with resistance of joint not more than that of the conductor
Conductors buried in earth	GS Flat or CCS
Conductors above ground level	GS Flat or CCS
Earth Electrode	32 mm or higher dia MS Rod or Copper bonded steel rod of dia. not less than 14 mm

Connection of riser to the structures shall be bolted or welded type. Portion of galvanised structure which undergoes welding at site shall be coated with two coats of cold galvanising and anti-corrosion paint afterwards.

Connections between equipment earthing leads and between main earthing conductors shall be of welded type. For rust protection, welds should be treated with red lead compound and afterwards thickly coated with bitumen compound. All welded connections shall be made by electric arc welding.

The Contractor shall furnish the detailed design and calculations for Owner's approval as per IS 3043 to determine the number of earth pit and size of earth conductor.

Buried earth conductor shall be laid all around periphery of solar array farm. GS flat above the ground for structure earthing shall be connected to the nearest buried conductor or electrode. All the earth electrodes shall be interconnected in single network/mesh and no electrode or group of electrodes shall be isolated/islanded. These electrodes shall be uniformly distributed in the solar farm at maximum practical extent and location of earth electrode shall be approved during detail engineering. A continuous earth path is to be maintained throughout the PV array. Each

PV Module frame shall be earthed in accordance with module manufacturer guidelines. In case module frame earthing is to be separately provided, it shall be earthed with minimum 2.5 SQMM flexible copper cables with lug at suitable location of module frame. Nos of PV modules in single loop of earthing connection to module frame shall be as per Module Manufacturer recommendations. Both ends of the loop of copper cable for earthing shall be connected with nearest earthed structure or earth conductor.

Necessary provision shall be made for bolted isolating joints of each earthing pit for periodic checking of earth resistance.

LIGHTENING PROTECTION SYSTEM

The specification is intended to outline the requirement of lightening protection for Solar array (DC) side and AC Power block side (Control room, inverter room, switchgear room etc) of Solar PV Project. It is not the intent of the specification to specify all details of design and construction since the bidder has full responsibility for engineering and implementation of earthling system meeting the intent of the specification and functional requirement.

The object of lightning protection system a is to protect buildings/structure and equipments from direct lightning strikes, potential fire as well as the effects of injected lightning currents. It comprises of termination systems for direct lightning, down conductors and an earth-termination system etc. as per approved drawings.

Lightning conductor shall be of 25x6mm GS strip when used above ground level and shall be connected through test link with earth electrode/earthing system.

Down Conductors:

Down conductors shall be as short and straight as practicable and shall follow a direct path to earth electrode.

Each down conductor shall be provided with a test link at 1000 mm above ground level for testing but it shall be in accessible to interference. No connections other than the one direct to an earth electrode shall be made below a test point.

All joints in the down conductors shall be welded type.

Down conductors shall be cleated on outer side of building wall, at 750 mm interval or welded to outside building columns at 1000 mm interval.

Lightning conductor on roof shall not be directly cleated on surface of roof. Supporting blocks of PCC/insulating compound shall be used for conductor fixing at an interval of 1500 mm.

All metallic structures within a vicinity of two meters of the conductors shall be bonded to conductors of lightning protection system.

Lightning conductors shall not pass through or run inside GI Conduits. Testing link shall be made of galvanized steel of size 25x 6mm. Hazardous areas handling inflammable/ explosive materials and associated storage areas shall be protected by a system of aerial earths oxide layer or foreign material.

Lightning Protection System for Solar Array:

Complete Solar Array with associated structure shall be protected from Direct Lightning Stroke. Lightning Protection for solar array shall be achieved with any or both of the following two systems as per specification provided in the following section.

i) Single Rod Air Terminal (Faraday Rods)

ii) Early Streamer Emission (ESE) Air Terminal

Suitable earthling and equipotential bonding shall be ensured for the air termination rods as per applicable standard/ Equipment manufacturer guidelines.

Current carrying parts and accessories such as clamps, fasteners, down conductor, Test links and earth termination etc. shall be preferably procured from OEM of Air Terminals if it is supplied by them as part of lighting protection system.

i) Lightning Protection System for Solar Array with Single Rod Air Terminal

Solar array of plant shall be protected from direct lightning strike with straight or angled air termination rods of suitable class as per IS:2309 to be fixed with the module mounting structure (MMS). Air termination rods shall have minimum two clamps to be fixed with MMS and must be capable of carrying full lightning current. Contractor to ensure proper fixing of the clamps with MMS to allow lightning current to pass through the clamp without damage and to sustain the rods during high velocity wind.

Contractor shall submit the calculation to determine the no. and location of air termination rods to be fixed on structure to provide the lightning protection to each solar module and structure.

Earth riser shall be connected to that part/pole of MMS which is nearest to air termination rod.

ii) Lightning Protection System For Solar Array With E.S.E Air Terminal

Solar array shall be protected from direct lightning stroke with Early Streamer Emission air terminal in accordance to NF C 17-102 (Latest revision).

Location and layout of ESE terminal shall be in such a manner that it cast no shadow on the PV Modules during 8.30 AM to 4.30 PM. Any minor changes in timings shall be reviewed during detailed engineering stage, provided the proposal is acceptable to PV Module manufacturer and OEM certificate in this regard is submitted.

Number and location of ESE air terminal shall be decided during detail engineering. For this purpose, design calculation considering protection level III (minimum) and Autocad drawing of the layout of ESE terminal shall be submitted to owner for approval.

ESE air terminal shall be type tested as per Annexure- C of NF C 17-102 (Latest Revision) in the manner as mentioned in the standard type test report shall be submitted to owner for approval.

ESE Air terminal shall be supplied with test link, lightning stroke counter, down-conductor, Two earth pit, support mast and accessories required for completeness for ESE Lightning protection system. If required, Suitable guy wire shall be used to support the mast of ESE terminal against the wind.

Owner shall test ESE terminal (Each terminal/Sample basis) before installation with suitable instrument for functionality of terminal. Vendor shall replace the terminal free of cost if found defective.

Support mast for ESE Air terminal shall be heavy duty hot dip galvanized material and shall be suitable to withstand dynamic and static forces acting on it without failure. Foundation for the mast shall be M20 Grade concrete or better with minimum depth of 1200 MM.

~~**Lightning Protection System for Switchyard**~~

~~Direct stroke lightning protection (DSLP) shall be provided in the switchyard by LM/shield wires.~~

~~Lightning protection System down conductors shall not be connected to other conductors above ground level. Also, no intermediate earthing connection shall be made to Surge arrester, Voltage Transformer, earthing leads for which shall be directly connected to earth electrode.~~

~~Every down conductor shall be provided with a test joint at about 1000 mm above ground level. The test joint shall be directly connected to the earthing system. Down conductors shall be cleated on the structures at 2000 mm interval.~~

~~The lightning protection system shall not be in direct contact with underground metallic service ducts and cables.~~

~~Lightning protection system installation shall be in strict accordance with the latest editions of Indian Electricity Rules, Indian Standards and Codes of practice and Regulations existing in the locality where the system is installed.~~

Lightning Protection System for Building and Enclosure

Contractor shall provide lightning protection for Inverter room/shelter/enclosure, main control room, Switchgear Room/shelter and similar housing per IS/IEC 62305. ESE Air Terminal shall not used for lightning protection of Metering yard/ Switchyard .

16.6 Drawings, Documents and Design Calculations

16.6.1 Design Memorandum

The Contractor shall submit to Employer a design memorandum prepared in accordance to clause 1.6 “Record and Documentation” of “Section 1-General Technical Requirements.”

16.6.2 Drawings and Documents

The Contractor shall submit all the drawings and documents in accordance with requirements stipulated in “Section 2 - Technical Documents” of “General Technical Specification (GTS)”.

16.6.3 Design Calculation

The Contractor shall submit the design calculation in accordance to Clause 2.4 of “General Technical Specification (GTS)” covering at least the following, for review / acceptance.

i) Design calculations of the whole grounding system,

ii) The design shall be as per applicable rules and standards, "Guide for Safety in AC Substation Grounding" ANSI / IEEE Std 80-2000.

iii) The Contractor shall furnish the detailed design and calculations for Owner's approval for solar array earthing as per IEEE80-2000 to determine the number of earth pit and size of earth mat conductor. However the No. of earth pits for the solar farm shall be 1.25 earth pit (Min) per MW DC Capacity (Nos. of earth pit indicated is valid if all the earth pits are interconnected in single

mesh of earth pits). Location of earth pits and laying of earth conductor shall be decided during detail engineering.

iv) Connection of DC earthing system and AC earthing system with location and manner of connection shall be approved during detail engineering. Contractor shall submit the design calculation of earthing system of AC and DC side as standalone (no interconnection) system.

v) The Contractor shall also provide other calculations as required by the Employer for his approval of the contractor's design.

16.7 Delivery, Installation and Commissioning

The Contractor shall follow the requirements of Delivery, Installation and commissioning elaborated in clause 1.7 "Delivery, Installation and commissioning" of "Section 1 - General Technical Requirements."

16.8 Deleted

16.9 Tools and Instruments

The Contractor shall supply all necessary tools and instruments etc. for installation, repair and maintenance in accordance to clause 1.9 "Tools and Instruments" of "Section 1 - General Technical Requirements".

S.No.	Description	Quantity
1	Earthing Resistance Tester	01 Nos.

16.10 Quality Assurance and Testing

The Contractor shall follow the quality assurance and testing requirements as per approved "Quality assurance and Testing Specifications (QTS)".

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17 FIRE FIGHTING SYSTEM

17.1 Scope of Work

Scope of work under this section covers the provision of labour, tools, plants, materials and performance of work necessary for the design, manufacture, quality assurance, quality control, shop assembly, shop testing, delivery at site, site storage and preservation, installation, commissioning, performance testing, acceptance testing, training of Employer's personnel, handing over to employer and guarantee for two years of fire fighting system for Solar Photovoltaic (SPV) Power Plant and as per the specifications hereunder, complete with all auxiliaries, accessories, spare parts and warranting a trouble free safe operation of the installation.

Bidder shall comply with recommendation of Tariff Advisory Committee to incurring minimal premium for insurance.

The SPV plant shall be equipped with suitable fire protection & fire fighting systems for protection of entire equipment switchyard, control room etc as per CEIG requirements.

The scope of work shall be a comprehensive functional system covering all supply and services including but not be limited to following:

17.1.1 Fire Protection System

i) Fire Protection for different equipment as per NFPA standard

ii) Fire Fighting system (Sand Buckets, Portable Fire Extinguishers such as DCP Type, CO2 Type, Foam Type Hand Portable pressurized water C02 etc.) for Main Control Room (having SCADA Room, Battery Room, Panel Room, Store Room etc), Sub Pooling Switchgear Room, Inverter Duty Transformers, Station Service Transformer (if applicable), Auxiliary Transformer, PCU/ Inverter Rooms etc

iii) For Transformer, Nitrogen Injection based fire protection system shall be provided as per statutory requirement/relevant standard.

iv) Suitable Fire Protection & Fighting arrangements for Transformers shall be provided if applicable as per Tariff Advisory Committee (TAC)/statutory requirements.

v) 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 Employer approval. However for all oil filled outdoor transformer, a pit shall be provided all around at a distance of 1.0 meter (min.) from transformer outer edge. A sump pit shall be provided for each pit. The dimension of oil soak pits and its capacity should be durably marked for identification.

vi) Fire detection and alarm system for Main Control Room, Switchgear room, Transformer area, Inverter Rooms etc

vii) Notification devices such as fire horns/ alarms/ hooters/ bells, light or text display etc.

viii) One (1) microprocessor based addressable analogue, intelligent type main fire alarm panel located in control room,

Any other item(s) not mentioned specifically but necessary for the satisfactory completion of work defined above, as per accepted standard(s) best international practices.

17.2 Specific Parameters and Layout Conditions

17.2.1 Layout and General Arrangement

Microprocessor Based Fire Alarm Panel

Bidder to provide intelligent microprocessor based main fire alarm panel of modular construction complete with central processing unit, input and output modules, power supply module, supervision control and isolator modules with 10% spare provisions in each loop.

Fire detection alarm system shall include but not limited to the following items:-

a) Fire Alarm Control Panel

b) Multi Sensor Smoke Detector

c) Heat Detectors

d) Hooter cum strobe

e) Manual Call Point

f) Hooter

g) Fault Isolation Modules

h) Control Modules

i) Cables from Sensors to Fire panels.

j) Digital output from the fire detection system shall be integrated with SCADA

k) Network Control Module

l) Interfacing of Fire Alarm System with SCADA for display and storage of status and alarm in SCADA

Multi sensor type smoke detectors and heat detectors shall be provided for below false ceiling areas of control room and ACDB and/or inverter rooms etc.

One (01) sensor shall be provided for each 20 sq. Meter of area.

All the cable trench inside the control room, inverter room etc. shall be provided with Multi Sensor smoke detector. Fault Isolation module shall be provided in every room and for every 15 sensors at location proposed by Bidder to be approved by employer during detail engineering.

Fire Alarm Control Panel Indication

Alarm conditions shall be immediately displayed on the control panel and in SCADA. Alarm LED shall flash on the control panel until the alarm has been acknowledged. Once acknowledged the LED shall remain lit. A

subsequent alarm received from another zone after acknowledgement shall illuminate the alarm LED and the panel display shall show the new alarm information.

During an alarm condition, an alarm tone shall sound within the control panel until the alarm is acknowledged.

If the audible alarm signals are silenced for any reason, they shall automatically resound if another zone is activated.

All alarm signals shall be automatically “locked in” at the control panel until the operated device is returned to its normal condition and the control panel is manually reset

There shall be weather proof Hooter cum strobe outside and strobe inside each Inverter room and control room for indication fire alarm for respective zone/area at suitable location that is visible from all direction

All the hardware, relay and accessories required for completeness of fire alarm system is in Bidder scope. Each Inverter room and control room shall be also be provided with manual call point, Alarm acknowledge and reset facility for alarm for respective zone only.

Bidder shall submit document to employer for approval that will include fire alarm system configuration, layout, BoM, Datasheet and necessary test report.

Bidder shall consider 30 % design and aging margin for selection of nos. of sensors in each loop and length of each loop.

Bidder shall submit the certificate from OEM indicating maximum nos. of sensors in single loop and maximum length of single loop allowed with offered panel and type of cable to be used. Each Fire Alarm Control panel shall have provision for minimum 10 (Ten) % rounded to next higher integer but not less than 2 (two) nos. spare loops for future use of employer.

Bidder shall submit Site Acceptance Test (SAT) for approval by employer. Complete fire alarm system shall be checked at site for verification of faithful performance and completeness of the system. Bidder shall carry out necessary modification and supply hardware/accessories if required.

The complete fire detecting & fire fighting system shall be coordinated and established in accordance with latest standards.

17.3 Rating and Functional Characteristics

Ratings of complete fire fighting including auxiliary system shall be taken in accordance with prevailing standards & practices. They shall work satisfactorily for the specified conditions.

17.4 Performance Guarantee

The fire fighting system along with all auxiliaries and accessories shall be capable of performing intended duties under specified conditions. The Contractor shall guarantee the reliability and performance of the individual equipment as well as of the complete system.

17.5 Design and Construction

17.5.1 Standards

The system and equipment shall be designed, built, tested and installed to the latest revisions of the following applicable standards. In the event of other standards being applicable they will be compared for specific requirement and specifically approved during detailed engineering for the purpose:

S. No.	Standards	Description
1.	NFPA 72	National Fire Alarm Code
2.	NFPA10	Standard for portable fire extinguishers
3.	NFPA 14	Standard for the installation of stand-pipe, private hydrants, and hose systems
4.	NFPA 15	Standard for water spray fixed systems for fire protection
5.	NFPA 20	Standard for the installation of stationary fire pumps for fire protection
6.	NFPA 75	Standard for the protection of electronic computer/ data processing equipment
7.	NFPA 1221	Standard for the installation, maintenance, and use of emergency services communications systems

17.6 Drawings, Documents and Design Calculations

17.6.1 Design Memorandum

The Contractor shall submit to Employer a design memorandum prepared in accordance to clause 1.6 “Record and Documentation” of “Section 1- General Technical Requirements.”

17.6.2 Drawings and Documents

The Contractor shall submit all the drawings and documents in accordance with requirements stipulated in “Section 2 - Technical Documents” of “General Technical Specification (GTS)”.

17.6.3 Design Calculation

The Contractor shall submit the design calculation in accordance to Clause 2.4 of “General Technical Specification (GTS)” for review / acceptance.

17.7 Delivery, Installation and Commissioning

The Contractor shall follow the requirements of Delivery, Installation and commissioning elaborated in clause 1.7 “Delivery, Installation and commissioning” of “Section 1 - General Technical Requirements.”

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17.10 Quality Assurance and Testing

The Contractor shall follow the quality assurance and testing requirements as per approved “Quality assurance and Testing Specifications (QTS)”.

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18 OUTDOOR SWITCHYARD

18.1 Scope of Work

Scope of work under this section covers the provision of labour, tools, plants, materials and performance of work necessary for the design, manufacture, quality assurance, quality control, shop assembly, shop testing, delivery at site, site storage and preservation, installation, commissioning, performance testing, acceptance testing, training of Owner's personnel, handing over to employer and guarantee for two years of outdoor Switchyard for Solar Photovoltaic (SPV) Power Plant & Park and as per the specifications hereunder, complete with all auxiliaries, accessories, spare parts and warranting a trouble free safe operation of the installation.

The scope of work shall be a comprehensive functional system covering all supply and services including but not be limited to following.

18.1.1 Outdoor Switchyard Equipment

The switchyard shall be 33/ 220kV of the outdoor type. The power transformers are however covered elsewhere in the specification. The various bays in the outdoor switchyard shall be as detailed below.

Supply, installation and commissioning of switchyard equipment and necessary protection arrangement at Plant end shall be as per the OPTCL, CEA & CEIG requirement and norms and to the satisfaction of employer including statutory inspection. The 220 kV side equipments rating, bus bar arrangement, conductor sizing, control, protection, telemetry etc. shall also be as per the requirement and norms of OPTCL/ CEA and the drawings/documents of the same shall be got approved through OPTCL by contractor before submitting to owner.

18.1.1.1 Switchyard Equipment & Arrangements

The switching station shall be as per the OPTCL norms, requirement and as per the connectivity permission provided by OPTCL vide letter dated 29.4.2020 **(Annexure-4).** The scope of work shall cover all supply and services for completeness of the system but not be limited to following:

1. The switchyard will have one no 220 kV incoming feeder bay, one no 220 kV outgoing feeder bay (For LILO Arrangements), one no feeder bay for interconnection with solar plant and one no bus coupler bay with two main bus arrangement.

2. Each bay shall comprise of atleast the following:-

   - 3-pole SF6 gas insulated circuit breaker, complete with operating mechanism,
   - Three (3), single phase multi core, multi ratio current transformer,
   - Isolator & Beam Mounted Isolator with or without Earth Switch,

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complete with manual and motor driven operating mechanism along with local control cubicle as per OPTCL requirement.

- Three(3) nos non linear metal oxide resister type Surge Arresters complete with discharge counter, leakage / grading current meter and insulator,
- Energy meters as per Chapter of Control and Monitoring (SCADA) System
- Any other equipments as per requirement of OPTCL

3. Wave trap and Line Matching Unit as per system requirement

4. **Capacitance Voltage Transformers : 3-core single phase capacitance vo**ltage transformers (CVT) complete with supporting structures and junction box for each HV bus and line bus.

5. Other arrangement, requirement of Control Room, Metering, Protection, Integrated communication system, voice communication facilities (landline/WLL/ Cell Phone), space for additional bays, metering, approach road to Switching Station, Air Conditioning, Auxiliary Supply, Documentation, Integrated Substation Control and Protection System (Substation Automation) for switching substation with adequate redundant communication with HMI at Bhanjanagar Substation for remote control of switching station etc shall be as per OPTCL requirements.

18.1.1.2 Structure Accessories and Auxiliaries

(i) One (1) lot of conductor as required to complete the system with bus bar arrangement (as per OPTCL Requirement) in the switchyard,

(ii) One (1) lot of galvanized gantry structures and supporting structures required to complete the switchyard system,

(iii) One (1) lot of insulators, hardware fittings, fasteners, lightning masts, earthing risers for equipment and gantry structures, earth wire including arrangement for screening of switchyard for protection against lightening,

(iv) Necessary quantity of Marshalling Kiosks for ease of construction and operation,

(v) One Name plates and two danger Plates of more than 300 X 300mm size for each bay,

(vi) Continuous on-line monitoring for operating parameters such as current, voltage, temperature etc. complete with sensors, control/processor units, wiring/cabling in all respect and coordination & provision of necessary contacts and/or ports for integration with plant SCADA system,

(vii) All necessary auxiliaries for control &supervisory circuits, local control switches and other relays as required,

(viii) All secondary wiring, terminal blocks, labelling, nameplates, sockets etc.

(ix) Transformer and Line Control & Relay Panel

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(x) Complete Fire Fighting System

(xi) PLCC/OPGW and/or any other means as per system requirement, OPTCL norms / requirements for speech transmission, line protection, data channels etc.

(xii) Spare parts as per clause no. 18.8,

(xiii) Tools & instruments as per clause no. 18.9,

(xiv) Any other item(s) not mentioned specifically but necessary for the satisfactory completion of scope of work defined above, as per accepted standard(s) / best international practices.

18.2 Specific Parameters and Layout Conditions

18.2.1 Layout and General Arrangement

Unless otherwise as mentioned in clause 18.1.1 above, all the switchyard equipments for the Switchyard have to be placed in a single area located outdoor.

18.3 Rating and Functional Characteristics

18.3.1 Outdoor Switchyard Equipment

System Parameters	HV system
Installation	Outdoor
Type of Busbar Arrangement	As per OPTCL requirement
Total No. of Bays	As above
Nominal Voltage , kV, RMS	220
Highest System Voltage, kV	245
Rated Frequency, Hz	50 ± 5%
Rated Continuous Current, A, RMS	As per the system requirement
Rated Short Time Withstand Current (RMS) for 1 sec.	40 kA
Rated Peak Withstand Current, k A	100 kA
Rated Duration of Short Circuit (SC)	1 Sec
Rated Insulation Level	
One Minute Power Frequency Withstand Voltage	
Dry (kVrms)	460
Wet (kVrms)	530
Rated Lightning Impulse Withstand Voltage ((1.2/50 micro sec.) (kVpeak)	
Line To Earth (kVp)	1050

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Across Isolating Distance (kVp)	1200
Minimum Creepage Distance , mm	6125
Rated Control Voltage DC, V	220 V
Auxiliary AC supply, 3 Phase, V	415 ±10 %
Partial discharge at 1.05 MCOV (Continuous operating voltage)	<50 pC
Maximum Radio Interference Voltage for any frequency between 0.5 MHz to 2.0 MHz in all positions (micro volts)	1000 (At 156 kV rms)
Degree of Protection	IP 55
Circuit Breaker	
Type	SF6
Description	Three Phase
Rated SC Symmetrical Breaking Current kA (r.m.s)	40
Rated SC Making Current, kA (peak)	100
Rated Line Charging Breaking Current Capacity, A	125
Rated Cable Charging Breaking Current Capacity, A	250
First-Pole-to Clear Factor	1.3
Closing Time	Maximum 150 ms.
Total Break Time for any current up to the Rated Breaking Current	Not more than 60 ms.
Rated Operating Duty Cycle	O-0.3Sec-CO-3 Min–CO
No of Trip Coils	2
Isolators	
Type	3 Phase Double Break
Operation	Motorised as well as Manual
Total Operating Time of isolator along with its operating mechanism	<12 s
Current Transformers	
Current Ratio Line Bay	As per system requirement
Current Ratio Power Tr. Bay (incoming)	As per system requirement
Accuracy Class For Protection	PS
Accuracy Class For Metering	0.2

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Surge Arrestors	
Rated Arrestor Voltage	216 kV
Rated Nominal Discharge Current (8/20μs wave)	10 kA
Continuous Operating Voltage (COV) at 50 Deg C	168 kV rms
Energy Dissipation Capability	Not less than 5 KJ/kV
Partial discharge at 1.05 MCOV (Continuous operating voltage)	<50 pC
Capacitive Voltage Transformers for HV Bus	
Purpose	Metering & Protection,
Voltage Ratio	As per system requirement
Accuracy Class for Metering & Protection	0.2 (1-core) & 3P (2-core) respectively
Number of Cores in Secondary side	3
Rated Voltage Factor	1.5 for 30 s & 1.2 Continuos
Partial Discharge at Highest Voltage	<10 pC
Insulation Class	A

18.4 Performance Guarantee

The outdoor switchyard equipment along with all auxiliaries and accessories shall be capable of performing intended duties under specified conditions. The Contractor shall guarantee the reliability and performance of the individual equipment as well as of the complete system.

18.5 Design and Construction

18.5.1 Standards

The system and equipment shall be designed, built, tested and installed to the latest revisions of the following applicable standards. In the event of other standards being applicable they will be compared for specific requirement and specifically approved during detailed engineering for the purpose:

Standards	Description
IEC 60265	High Voltage Switches
IEC 60439/60947	Low Voltage Switchgear and Control gear
IS: 9920	HV Switches

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Standards	Description
IS:9921	Alternating Current Disconnector (Isolators) and Earthing Switches
IS 3156	Potential Transformers
IS 2705	Current Transformer
IEC-60186	Voltage transformers
IEC-60099-4/ IS 3070	Metal Oxide Surge Arresters without gaps for AC systems
IEC62271 (All Parts)	High Voltage Switchgear and Control Gear
IEC 60044-1	Instrument Transformers - Part 1 : Current Transformers
IEC 60044-2	Instrument Transformers - Part 2 : Inductive Voltage Transformers
IEC 60044-6	Instrument Transformers - Part 6 : Requirements for protective current transformers for transient performance
IEC 62271-100	High Voltage Switchgear and Control gear - Part 100: High-voltage alternating-current circuit-breakers
IEC 62271-200	High Voltage Switchgear and Control gear - Part 200: A.C. metal-enclosed switchgear and control gear for rated voltages above 1 kV and up to and including 52 kV
IS 802	Code for use of Structural Steel in Overhead Transmission Line Towers
IS 875	Code of Practice for Design Loads (other than Earthquake) For Buildings and Structures

18.5.2 General

It is under stood that each manufacturer has its own particular design concept and it is not the purpose of this specification to impose unreasonable restrictions. However in the interest of safety, reliability and maintainability, the switch gear offered shall meet the following minimum modular design requirements.

18.5.3 Circuit Breakers

The circuit breakers shall be of SF6 type with three phase metal clad breaker poles. The mechanism shall be trip free mechanically or electrically with anti pumping device. SF6 circuit breakers shall conform to IEC-62271-100&200. Sufficient auxiliary contacts of the breakers shall be provided for the local and remote indications, the performance of various control and protection schemes and the interlocking scheme. Alarm and cut-off contacts for mechanism faults and gas pressure loss shall also be provided. The circuit breaker shall be capable of being operated locally or from remote.

18.5.4 Isolators

The Isolators shall comply with the general requirements of relevent IS/ IEC. 62271-102. Isolators shall be of the 3-phase, group-operated type. Some of them shall be with manual & 220 V/110 DC motor-operated mechanism and some of them shall be with manual operating mechanism. Sufficient auxiliary contacts shall be provided for indications (local & remote), interlocking schemes and the performance of various control & protection schemes manual and motor driven operating mechanisms The earth switch used along with isolator shall be hand operated and shall be mechanically interlocked with its associated isolator and electrically interlocked with its associated circuit breaker.

18.5.5 Current Transformers

The Current Transformer shall have multi core with multi ratio, which shall be changeable by means of taps on secondary side. Independent cores shall be used for different purposes.

The metering CTs secondary cores for interface tariff shall be brought out in separate sealable boxes

18.5.6 Surge Arrestor

The lightning arresters shall conform to IEC-60099-4 and IEC-60037 WG 4. The arresters shall be hermetically sealed, heavy-duty station class and gapless type. The arresters shall be connected to the outdoor bus bars. The rating shall be as indicated above.

18.5.7 Capacitive Voltage Transformers

The capacitance voltage transformers shall conform to IEC-60186. The CVTs shall be oil-filled and self-cooled. They shall be single-phase units consisting of coupling capacitor dividers and auxiliary electromagnetic transformers.

18.5.8 Grounding

The grounding system is to be designed according to the relevant IEC/VDE/IS/IEEE80 standards. All cubicles, steel structures, mounting supports and apparatuses are connected to the grounding system. All connections (crossing points and connections to apparatuses etc.) are welded. The supply and design of ground mat for plant and switchyard shall fall in scope of grounding system.

18.5.9 Marshalling Kiosk

Marshalling Kiosk of suitable dimension with requisite terminal blocks shall be provided. The TB shall be suitable for connecting wires on each side. In addition terminal blocks for Power Supply distribution to all the equipment in the bay shall be provided.

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18.5.10 Steel Structure

Manufacturer shall supply switchyard structures, all supporting structure for equipments, required access ladders / stairway / walkways, transverse and longitudinal beams and supporting members, complete with all necessary hardware. The steel structures shall be hot dip galvanised as per the provision of relevant standards. Any temporary scaffolding or a moveable platform required for maintenance shall also be supplied. The structure shall be designed as per the latest edition of Indian Standard current in use.

18.5.11 Name Plate

The switchyard equipment shall have a rating plate with the information required by relevant IEC i.e. at least the following:

- Manufacturer's name
- Type number
- Serial number
- Rated voltage
- Rated impulse withstand voltage
- Rated power frequency withstand voltage
- Rated frequency
- Rated current
- Rated short circuit breaking current
- Rated short time current (r.m.s), & duration

Each instrument transformer must have its own rating plate with the information as required in IEC 60044-1 and IEC 60186.

18.5.12 Connectors

The connectors used in the Switchyard shall be made of Aluminium alloy and shall be free from defects and sharp edges so as not to cause corona, radio and audible noise, interference in the HV installations. The connectors shall conform to NEMA 107 and tested accordingly to have maximum noise level not exceeding 54dB. The fasteners shall conform to ISO 3506 and having minimum mechanical strength of class 70. The tensile strength/electrical characteristics of the hardware shall be in accordance to NEMA CC1 publications.

18.6 Drawings, Documents and Design Calculations

18.6.1 Design Memorandum

The Contractor shall submit to Owner a design memorandum prepared in accordance to clause 1.6 "Record and Documentation" of "Section 1-General Technical Requirements."

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18.6.2 Drawings and Documents

The Contractor shall submit all the drawings and documents in accordance with requirements stipulated in "Section 2 - Technical Documents" of "General Technical Specification (GTS)". Design Calculation

The Contractor shall submit the design calculation in accordance to Clause 2.4 of "General Technical Specification (GTS)" covering at least the following, for review / acceptance.

- Calculation of power requirement for operating mechanism of breakers and other switches like isolators.
- Data/calculations in regard to the loads under severe short circuit conditions to be transferred
- Calculations of the stresses for the sidewall beam / gantry structure
- Calculation for design of steel structure and load on foundation
- Calculations for burden of CT, and CVT
- Validation of protection margins in SA characteristics along with calculation for deciding location
- Calculation for lightening protection,
- Calculation for Short circuit forces,
- Calculation for Sag & Tension.
- Calculation of conductor temperature rise.

18.7 Delivery, Installation and Commissioning

The Contractor shall follow the requirements of Delivery, Installation and commissioning elaborated in clause 1.7 "Delivery, Installation and commissioning" of "Section 1 - General Technical Requirements."

18.8 Spare Parts

18.8.1.1 Switchyard

In accordance to clause 1.8 "Spare Parts" of "Section 1 - General Technical Requirements". Specified spare parts to be supplied under this section are as follows:

S. No	Description	Quantity
1	Capacitance Voltage Transformer	1 No.
2	Surge Arrester	1 No.
3	Pole of Circuit Breaker complete with Interrupter unit , operating mechanism and tie rod etc	1 No.
4	Complete Drive mechanism including motor for disconnector switches	1 No.

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5	Trip coils for Circuit Breakers	2 Nos.
6	Closing coils for Circuit Breakers	2 Nos.
7	CT each type used	1 No.
8	Isolator Limit Switch	1 No.

18.9 Tools and Instruments

The Contractor shall supply all necessary tools and instruments etc. for installation, repair and maintenance in accordance to clause 1.9 "Tools and Instruments" of "Section 1 - General Technical Requirements".

The proposed list of tools must include the following

- Two (2) nos. telescopic extension piece type earthing rod (3 Phase) suitable for outdoor switchyard voltage rating and tested for making capacity
- Two (2) nos. 500 V/ 1 KV / 2.5 KV / 5 KV user selectable digital Megger

18.9.1 Deleted

18.9.2 Deleted

18.10 Quality Assurance and Testing

The Contractor shall follow the quality assurance and testing requirements as per approved "Quality assurance and Testing Specifications (QTS)".

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19. POWER EVACUATION SYSTEM

19.1 Scope of Work

Scope of work under this section covers the provision of labour, tools, plants, materials and performance of work necessary for the design, manufacture, quality assurance, quality control, shop assembly, shop testing, delivery at site, site storage and preservation, installation, commissioning, performance testing, acceptance testing, training of Owner's personnel, handing over to employer and guarantee for two years of power evacuation system for Solar Photovoltaic (SPV) Power Plant & Park as per the specifications hereunder, complete with all auxiliaries, accessories, spare parts and warranting a trouble free safe operation of the installation.

The scope of work shall be a comprehensive functional system covering all supply and services including but not be limited to following.

19.1.1 Power Evacuation System

This specification covers construction of overhead transmission lines including Loop in Loop out (LILO) work and associated equipment. The switchyard equipments are covered under Chapter – 18 "Outdoor Switchyard" in the specification.

The grid connectivity permission has already been granted by OPTCL. The validity extension of connectivity permission shall be in the scope of NHPC, however, if any assistance is required, same shall be provided by the contractor. The execution of transmission line, substation etc shall be carried out by the contractor as per scheme approved by OPTCL and also in close coordination with OPTCL. Connectivity Permission granted by OPTCL is attached as **Annexure-IV**.

"In addition to all the requirements mentioned here under in the Technical Specification, responsibility of fulfilling all the technical/metering/protection requirement specified in the Agreement for Solar PV Plant to be signed/ signed with OPTCL/GEDCOL, terms and conditions mentioned in the connectivity permission provided by OPTCL and all other requirements as per OPTCL norms including compliance of statutory requirements shall also be on the Contractor's scope."

Transmission line includes tapping of one circuit of the existing 220kV Bhanjanagar –Nayagarh line of OPTCL by LILO arrangement, stringing of line from LILO point to plant end switchyard and back to LILO point/ or other suitable location on double circuit tower as per requirement including earth wire/OPGW, jumpers etc. Dismantling and all other works required to complete the system shall also be in the scope of contractor.

The transmission line including LILO works shall be designed as per the norms of OPTCL. The major equipments and material shall be from the approved vendors of OPTCL. All the Drawings/ documents pertaining to tower, transmission line, tower foundation, land schedule of line, earth mat design calculation with soil resistivity and other data, control, protection and metering, telemetry drawing etc shall be got certified through OPTCL

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by the contractor before submitting it to the owner. The location of LILO arrangement is approximately 2 Km away from project site. If replacement/ modification are required in the existing tower structure to make LILO arrangement, the same shall be in the scope of contractor.
In addition to above, the following shall also be applicable:-

(i) Details of connection, technical requirements with reference to reactive power compensation (if applicable) shall be in accordance with relevant provision of Indian Electricity Grid Code.

(ii) Contractor shall abide by the provision of Odisha Electricity Grid Code, Indian Electricity Grid Code (IEGC) and CEA connectivity Regulation 2004, for protection, safety and communication requirements, CEA regulation in Installation and operation of meters for metering provisions.

(iii) The data communication system between generating station and grid substations of OPTCL/ LDC shall be finalised in consultation officials of OPTCL and as per guidelines of CEA.

(v) All Statutory requirements like compliances of applicable provisions of standards on Grid Connectivity and Grid Standards specified by CEA, IEGC, SEGC in force, PTCC and other statutory approvals, inspection by Electrical Inspectorate, Odisha, OERC guidelines and norms etc shall be complied by Contractor.

19.1.2 Power Evacuation Equipment

This specification covers construction of overhead transmission lines including LILO work on existing line. The transmission/distribution lines shall conform in all respects to highest standard of engineering, design workmanship, this specification and the latest revisions of relevant standard.

The scope of work shall be complete in every respect including but not be limited to following:

i) Preliminary route survey, finalization of route alignment, detailed survey, structure (tower) spotting, optimization of structure location, geo-technical investigation etc in consultation with OPTCL/ through OPTCL. The actual expenditure of the said work shall be in the scope of contractor.

ii) Design, testing, supply and erection of transmission line with support structures, conductor, earth wire/ OPGW (as applicable) including insulators, hardware fittings, fasteners cross arms, bolts, nuts and washers, D-shackles and all type of accessories including danger plate, anti-climbing and earthing devices per OPTCL norms & specifications.

iii) All type of erection including termination and dismantling work to make LILO arrangement

iv) Design, selection and casting of foundations for structures required for the lines and other associated civil works.

v) Painting of towers & supply and erection of span markers, obstruction

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lights (wherever applicable) for aviation requirements (as required)

vi) Since there will be LILO on existing lines, the extension ,modification etc of existing telecontrol system (PLCC/OPGW etc), protection system etc impacted by the LILO work, shall be under the scope of the contractor and the same shall be carried out as per OPTCL norms and requirement. Any other work including equipments, if required, for completeness of system as per OPTCL requirement shall also be in the scope of contractor.

vii) Spare parts as per clause no. 19.8,

viii) Tools & instruments as per clause no. 19.9,

Any other item(s) not mentioned specifically but necessary for the satisfactory completion of scope of work defined above, as per accepted standard(s) / best international practices.

19.2 Specific Parameters and Layout Conditions

19.2.1 Layout and General Arrangement

The power generated from the solar power plant shall be evacuated by making LILO of existing Bhanjanagar – Nayagarh line which is passing approximately 2 Km from project site. The conductor used for power evacuation shall be of similar or higher rating as that of existing Bhanjanagar – Nayagarh line and same shall be as per the standard practice.

If river crossing of transmission line is required, the contractor shall prepare the crossing plan and profile and also carry out soil investigations. Based on this information, Contractor shall propose an optimum location for the crossing and dimensions for it sub-spans, which shall be submitted to Engineer-in-charge for approval prior to further work being carried out. Major long-span river crossing are not covered in this specification, if required, a separate specification for the crossing and anchor structures shall be provided.

The contractor shall be responsible for any discrepancies, errors or omissions in the particulars and guarantees, whether such particulars and guarantees have been approved by the Engineer-in-charge or not.

Testing, commissioning and handing over of lines shall be as per the detailed technical specification and OPTCL requirement.

19.3 Rating and Functional Characteristics

19.3.1 Power Evacuation Equipment

System Parameters	Power Evacuation System/ Transmission Line
Total no. of Phases	3
Nominal Voltage , kV, r.m.s	220
Maximum Voltage, kV, r.m.s	245

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Rated Frequency, Hz	50 +- 5%
Rated Continuous Current, A, r.m.s	As per the system requirement
Lightning Impulse Withstand Voltage (1.2/50 micro sec.) (kVpeak)	1050
One Minute Power Frequency Withstand Voltage kV r.m.s	460
Rated Duration of Short Circuit (kA)	As per IS/IEC
Rated Control Voltage DC, V	220V +10% /-20%
Auxiliary AC supply, 3 phase, V	415 ± 10%

19.4 Performance Guarantee

The power evacuation equipment along with all auxiliaries and accessories shall be capable of performing intended duties under specified conditions. The Contractor shall guarantee the reliability and performance of the individual equipment as well as of the complete system.

19.5 Design and Construction

19.5.1 Standards

The system and equipment shall be designed, built, tested and installed/erected in accordance with the latest editions of Indian Electricity Rules, CBIP guidelines and of the following applicable standards. In the event of other standards being applicable they will be compared for specific requirement and specifically approved during detailed engineering for the purpose:

Standards	Description
IS 2062-1992	Specifications of Steel for general structure purposes
IS:808-1989	Specification for Hot rolled steel beam
IS:5613 (Part-2)-1985	Specification for design, installation and maintenance of overhead power lines
IS:2486	Insulator fittings for Overhead Power Lines
IS 2544	Porcelain post insulators for systems with nominal voltage greater than 1000 Volts
IS:456	Specification for plain and reinforced concrete
IS:1498	Classification and Identification of Soil for General Engineering purposes
IS:1888	Method of Load tests in soil
IS:1892	Code of practice for surface investigation for foundations

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Standards	Description
IS:398	Aluminium conductor
IS:731	Porcelain insulators for overhead power lines
IS:2486	Insulator fitting for overhead power lines
IS:5300	Stay insulator
IS:2141	Galvanised steel wire
IS:2629	Hot dip galvanising of steel and iron
IS:6005	Phosphating of iron and steel
IS:2121	Overhead power lines fittings
IS:2016	Plain washers
IS:2633	Tests on galvanised steel
IS:3043	Code of practice-earthing
IEC 60694	Common specifications for high-voltage switchgear and control gear standards
IEC-60186	Voltage transformers
IEC-60099-4	Metal-oxide surge arresters without gaps for AC systems
IEC62271 (All Parts)	"High voltage switchgear and control gear",
IEC 60044-1	Instrument transformers - Part 1 : Current transformers
IEC 60044-2	Instrument transformers - Part 2 : Inductive voltage transformers
IEC 60044-6	Instrument transformers - Part 6 : Requirements for protective current transformers for transient performance
IEC 62271-100	High-voltage switchgear and control gear - Part 100: High-voltage alternating-current circuit-breakers
IEC 62271-200	High-voltage switchgear and control gear - Part 200: A.C. metal-enclosed switchgear and control gear for rated voltages above 1 kV and up to and including 52 kV
IS 802	Code for use of Structural Steel in Overhead Transmission Line Towers
IS 875	Code of Practice for Design Loads (other than Earthquake) For Buildings and Structures

Contractor may also propose and furnish copy alternative standards along with bid, provided it is demonstrated that they give a degree of quality and performance equivalent to or better than the reference standards. The Engineer-in-charge shall adjudge whether to accept or reject any alternative standard. In case of conflict the order of precedence shall be 1) IEC or ISO Standards, 2) Indian Standards, 3) other alternative standards

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19.5.2 General

The transmission line shall be designed keeping in view all safety, reliability and maintainability aspects according to the latest standards/guidelines.

19.5.2.1 Minimum Clearance

The minimum clearance between the line conductors to ground or other objects and conductor phase spacing shall be as per relevant IS/IEC standard/ guidelines by OPTCL/CEA/CBIP. These clearances shall be obtained under conditions corresponding to the 75°C still air sag of the line conductors and with an angle of swing of the conductors from the vertical between 0° and 35°, assuming the aforementioned sag is always applicable.

19.5.2.2 Right of Way (RoW) for Transmission Lines

Right of way shall be arranged by the contractor. The cost of land for the transmission line (lease rent up to 27 years) to be arranged by the contractor and shall be deemed to be included in the price. The proof of arrangement of land, disbursement of compensation to land owners shall be submitted to the employer by the EPC contractor before commissioning.

19.5.2.3 Conflicts for Transmission Lines

Lines shall be located so as to minimize conflicts along the route. Support structure located in or at sites accessible to large trucks and mobile mechanical equipment shall be strategically situated so as to avoid vehicular contact and ensure adequate conductor to ground safety clearances. Special precaution shall be taken in to consideration for lines crossing roads, telecommunication circuits, rivers, roads, railways or near to building. Such lines shall be built to the specially stipulated security standards as per relevant IS/IEC standard/ guidelines by OPTCL/CEA/CBIP.

19.5.2.4 Steel Lattice Tower and Support Structure

For lines, the wind pressure and factor of safety etc. to be applied to the conductors, insulators, steel lattice tower and support structure are specified in IS:5613 and as per relevant IS/IEC standard/ guidelines by OPTCL/CEA/CBIP. Bidder shall take account of the wind loading regimes necessary for the projects for which he is bidding and shall propose the design of structures, which will prove most effective for the project and for the system.

The working load on the structures should correspond to those that are likely to come onto the structure during their service life.

19.5.2.5 Pole Accessories

Anti Climbing Device:

Fully galvanised barbed wire type confirming to IS: 378 (1978) anti-

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climbing device shall be provided at a height of approximately 3 m as an anti climbing measure.

Guarding mesh shall be used in all electric line/telecom line/road/canal crossing and at all points as per statutory requirement.

Pole accessories like danger plates, phase plates and number plates shall be provided.

Earthing of Pole/Structure:

All steel support inclusive of metal fittings shall be permanently and efficiently earthed as per relevant IS/IEC standard/ guidelines by OPTCL.

Marking on Pole/Structure:

The pole/structure shall be clearly and indelibly marked with following particulars:

a. Month and year of manufacture

b. Marker's serial no. and mark.

19.5.2.6 Line Conductor

The conductor shall be ACSR type and comply to IS: 398 (Part-IV).

19.5.2.7 Insulator

Suspension and tension insulator set of the cap and pin, pin or post type insulator, shackle insulator and stay insulator shall comply in all respect with the system requirement.

All insulators and insulator fittings shall be handled carefully during transportation, assembly and installation on the support structure to avoid chipping or damage shall be cleaned when installed. Proper precautions shall also be taken to ensure that they are not strained or damaged during erection or during the pulling in of the conductors.

19.5.3 Deleted

19.6 Drawings, Documents and Design Calculations

19.6.1 Design memorandum

The Contractor shall submit to Owner a design memorandum prepared in accordance to clause 1.6 "Record and Documentation" of "Section 1- General Technical Requirements."

19.6.2 Drawings and Documents

The Contractor shall submit all the drawings and documents in accordance with requirements stipulated in "Section 2 - Technical Documents" of "General Technical Specification (GTS)".

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19.6.3 Design Calculation

The Contractor shall submit the design calculation in accordance to Clause 2.4 of "General Technical Specification (GTS)" covering at least the following, for review / acceptance.

- Calculation for design of steel structure and load on foundation
- Calculation for Sag & Tension.
- Calculation of conductor temperature rise
- Calculation for Short circuit forces,
- Calculation of power requirement for operating mechanism of breakers and other switches like isolators.
- Data/calculations in regard to the loads under severe short circuit conditions to be transferred
- Calculations of the stresses for the sidewall beam / gantry structure
- Calculations for burden of CT and CVT
- Validation of protection margins in SA characteristics along with calculation for deciding location
- Calculation for Lightening Protection

19.6.4 Erection of Transmission Line

Erection of transmission line shall be done as per the latest IS/IEC standard/ guidelines by OPTCL/CEA/CBIP.

Pole/ Tower Foundation

The foundation criteria shall be determined from the classification of the ground into which the structure is to be erected and ground types. The allowable bearing pressure of the soil where the poles/structures are to be erected shall be based on adequate subsoil exploration and tests carried out in accordance with IS: 1888 and IS: 1892.

Where the bearing area of the support structure is insufficient to resist the overturning moment acting on the foundation, then the bearing area shall be increased by casting a concrete collar around the structure. The contractor shall demonstrate by calculation which option is required.

Distance between two poles/structures shall be decided by bidder based on loading and sag. The distance should be such that after sag minimum clearance as specified above is maintained between conductor and ground.

The factor of safety to be adopted as per IS/IEC standard.

Caution Plates, Number Plates and Circuit Plates

Each tower shall be fitted with Number Plates, Caution Plates (Danger Boards), Circuit Plates and Phase Plates. These shall be provided at appropriate level from the ground level (about 2.5 m to 3.5 m from ground level) so that the man standing at the foot ground tower will be able to clearly identify the same. These plates shall be 2 mm thick and

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vitreous enamelled on both back and front.

The letters, figures and the conventional skull and bones on danger plates, colour on phase plates shall be as per IS/IEC standard/ guidelines by OPTCL/CEA/CBIP.

Bird guards shall be as per saw tooth type confirming to Fig. 10 of IS-5613 Part-II/Sec-I or relevant IS/IEC standard/ guidelines by OPTCL/CEA/CBIP.

19.7 Delivery, Installation and Commissioning

The Contractor shall follow the requirements of Delivery, Installation and commissioning elaborated in clause 1.7 "Delivery, Installation and commissioning" of "Section 1 - General Technical Requirements."

19.8 Spare Parts

19.8.1 Power Evacuation Equipment

In accordance to clause 1.8 "Spare Parts" of "Section 1 - General Technical Requirements". Specified spare parts to be supplied under this section are as follows:

S. No.	Description	Quantity
1	Pin/ Disc Insulators String	3 Sets (each type)
2	Hardware fittings & fasteners of each type used	One (1) no of each type
3	Connectors on high voltage conductors	One (1) no of each type

19.9 Tools and Instruments

The Contractor shall supply all necessary tools and instruments etc. for installation, repair and maintenance in accordance to clause 1.9 "Tools and Instruments" of "Section 1 - General Technical Requirements".

19.9.1 Deleted

19.9.2 Testing Equipment

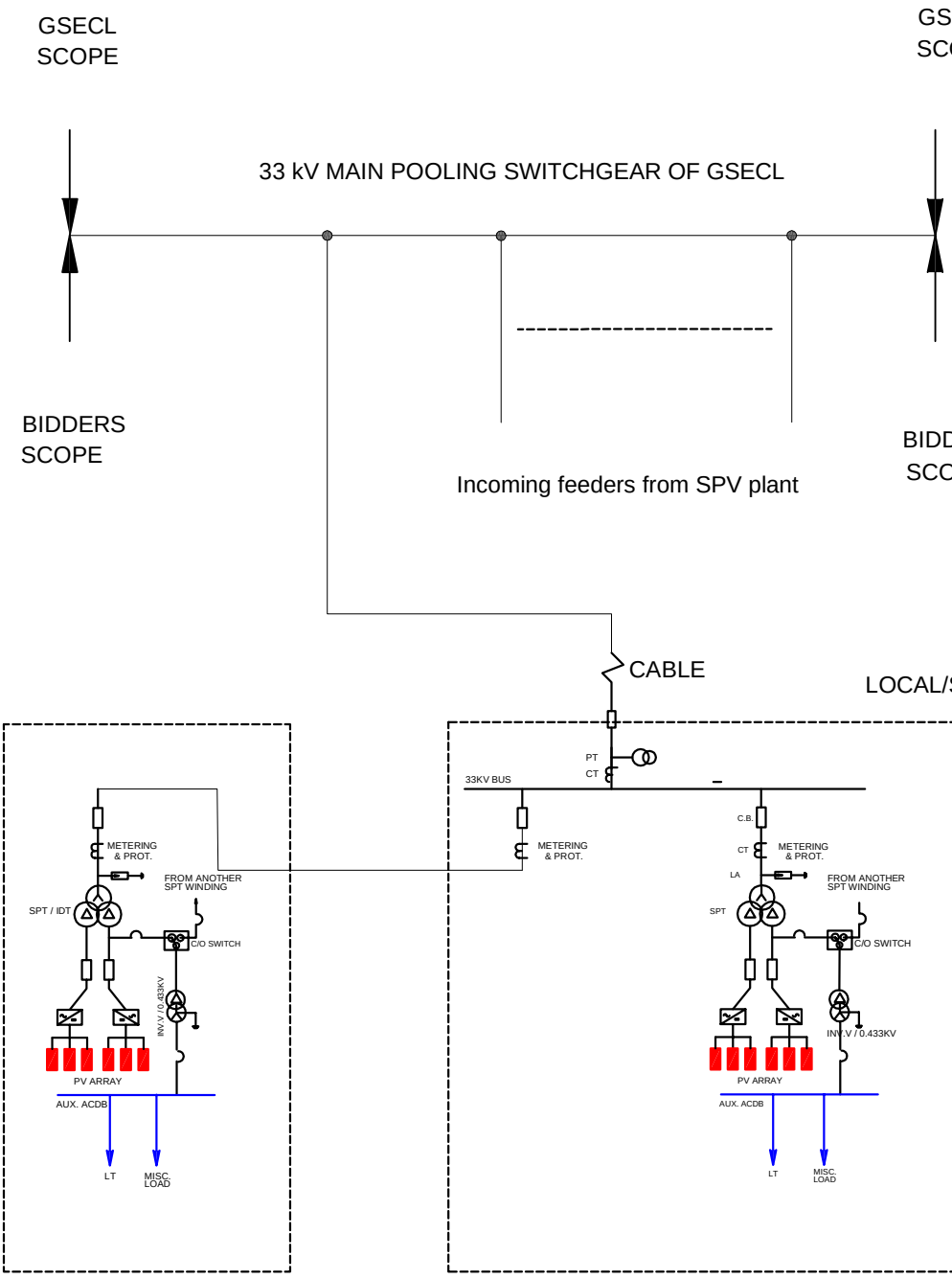
The Contractor shall propose the list of testing instruments including their make and detailed specification to be accepted by the Owner.

19.10 Quality Assurance and Testing

The Contractor shall follow the quality assurance and testing as per approved "Quality assurance and Testing Specifications (QTS)".

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ABBREVIATIONS

IE-I	ISO. WITH SINGLE EB
IE-2	ISO. WITH DOUBLE EB
I	ISO. WITHOUT EB
WT	WAVE TRAP
CB	CIRCUIT BREAKER
LA	LIGHTNING ARRESTOR
CVT	CAPACITIVE VOLTAGE TRANSFORMER
B/C	BUS COUPLER
I/C	INCOMER
CT	CURRENT TRANSFORMER
①	33 KV FEEDERS
PT	POTENTIAL TRANSFORMER
M	METERING EQUIPMENT
PCU	POWER CONDITIONING UNIT
SPT	SOLAR POWER TRANSFORMER

NOTE:

1. DETAILED PROVIDED IS INDICATIVE ONLY. FOR DETAILED SPECIFICATION OF EQUIPMENTS RATING, PROTECTION SYSTEM, ETC, BIDDER IS REQUESTED TO REFER TECHNICAL SPECIFICATION .
2. POWER SUPPLY TO BOTH THE INCOMING FEEDERS OF 415V LV SWITCH GEAR AT MAIN CONTROL ROOM SHALL BE FROM DIFFERENT SOURCES.
3. VECTOR GROUP OF IDT IS ONLY INDICATIVE IN NATURE AND SAME SHALL BE AS PER MANUFACTURER STANDARD

NHPC Limited
(A GOVT. OF INDIA ENTERPRISE)

200 MW SOLAR PV PROJECT AT KHAVDA, GUJARAT

INDICATIVE SINGLE LINE DIAGRAM

DRAWN		SUBMITTED BY SHAHID KHAN	RECOMMENDED BY SANJAY YADAV	APPROVED BY V.R. SHRIVASTAVA
DATE	JUNE. 2023	DRG. NO.	NH/RE/SOL/KHAVDA/01	REV-0

PART-B

EMPLOYER'S REQUIREMENT

TECHNICAL REQUIREMENT

CIVIL WORKS

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1. SURVEY

The Detailed Topographical survey of the proposed site shall be done by the Contractor and shall be approved by the Owner. The demarcation of land based on Location and Details of Land for the project as provided by the Owner shall be done by fixing the boundary stones approved by owner on the project boundary and in intermediate places if required. The boundary stones location shall be finalised in presence of representative of Owner. The study of the contours of the land shall be done by the Contractor based on the Detailed Topographical survey report. The contractor shall carry out the Bench Mark (GTS) to site/sites under survey by parallel levelling, establishing and constructing bench mark, grid and reference pillars in the field, spot level survey of the entire area/areas at an average 20 meters intervals and development of the contours. Contractor can also use Differential Global Positioning System (DGPS) for establishing the coordinates.

The field work shall be done with Total Station Equipment in the following steps:
Establishing horizontal and vertical controls and locating reference grids and benchmark in the area. Surveying for establishing spot levels and plotting contours. Surveying for locating the natural and manmade details. The grids for the survey work shall be established in N-S & E-W direction (Corresponding to Magnetic North).

Based on the above study, the Contractor thereafter shall prepare a detailed PV -array layout which shall be used by the Contractor for designing the general layout with clear demarcation showing boundary wall, boundary pillars, location of control room, array yard, approach road, internal roads, power lines and general drainage etc. All the maps should be prepared in digitised forms using computer software like AutoCAD – Release 2021 or latest available.

2. GEO-TECHNICAL INVESTIGATIONS AND TESTING

Geo-Technical Investigations and Testing of the proposed site where structures to be founded shall be got done by the Contractor at his own cost. All testing shall be done in the presence of the engineer or his authorized representative in a NABL accredited / Govt. Laboratory acceptable to and approved by the Owner. This includes reputed government / autonomous laboratories / organizations, and other reputed testing laboratories. The test samples for such test shall be jointly selected and sealed by the engineer and contractor and thereafter these shall be sent to the concerned laboratory through the covering letter signed by Owner engineer. The interim and final reports shall be made available as and when received, to the Owner.

Field test shall include but not be limited to the following:
Boreholes, Standard Penetration Test (SPT), collection of disturbed and undisturbed soil samples (UDS), Trial Pits (TP), collection of water samples, Electrical Resistivity Test (ERT) etc.
Minimum 1 No. of borehole of 5m depth (min) shall be carried out in every 12.5 acres of land. Minimum 1 ERT & 1 TPs shall be carried out for 100 Acres or below.
SPT shall be carried out in all types of soil deposits and in all rock formations with core recovery upto 20%, met within a borehole. This test shall be conducted at every 1.5 m interval or at change of strata. The starting depth of SPT shall be 0.5m from ground level. UDS shall be collected at every 1.5 m interval or at change of strata.

Contractor is required to consider the Geo-Technical parameters of the proposed site as per the final Geo-Technical Investigations and Testing report vis-a.-vis locations of various structures required for the project to design suitable foundations for the respective structures. Further, based on the Geo-Technical Investigations and Testing report, the Contractor shall arrange for Geo-Technical improvement wherever necessary.

3. PLANNING AND DESIGNING

The solar plant shall be designed so as to conform to the latest engineering designs, architectural values and aesthetic features etc. The Contractor has to plan and design all the Civil Engineering Structures/ other items as per the topographical survey and Geo-Technical Investigations and Testing reports.

The Contractor shall develop general layout drawing of which shall include but not limited to plant array field, internal roads and pathways, drainage system, approach roads (ensuring no water logging in the plant premises) along with sanitary plumbing layout etc. All designs & drawings have to be developed based on specifications given in the tender and relevant IS codes unless otherwise specified;

Bidder shall have to submit all data pertaining to the Survey and Array layout in original (.dwg & .pdf format) including all levels & co-ordinates in X-Y-Z format for the entire area in scale in soft copy in Pen Drive (3 nos) and hard copy (3 nos in A0 size).

All details related to internal electrification, water supply, fencing, access roads, sewerage system and other important features should be clearly shown in the drawing.

4. SITE DEVELOPMENT

Solar Project is located in the Kutch region of Gujarat which is mostly covered with salt encrustation, a hard layer that is formed due to evapotranspiration from the surface. The soil seems to be very fine silty clay having low shear strength. The area is earthquake prone and falls in seismic zone V.

Before submitting his bid, the bidder should inspect and examine the site and its surroundings and should satisfy himself as to the nature of the ground and subsoil, the quantities and nature of work, materials necessary for completion of the work and their availability, means of access to site and in general shall himself obtain all necessary information as to risks, contingencies and other circumstances which may influence or affect his offer. No consequent extra claims on any misunderstanding or otherwise shall be allowed by the Employer.

All works related to site clearance including removal of bushes, trees, levelling, grading, finishing and other additional works within the plot shall be carried out by the Contractor. Mandatory permission/ licenses/ statutory clearances from Competent Authorities for site levelling activities like removal of tree and bushes, undertaking blasting related works, disposal of cutting material etc. shall be carried out by the contractor.

Site grading level shall be fixed with due reference to site drainage of the whole area, existing drainage pattern, maximum flood level and system requirements.

Site levelling works/scheme shall match with the specific functional requirement of Solar PV optimum generation considering the full utilization of the plot area for the desired capacity after considering the boundary and fencing requirements.

Based on the spot level, contour survey done and meeting above requirements, bidder can propose different site grade levels. The site levelling may be carried in patches/blocks. Bidder may also propose the site levelling and grading matching with the natural topography of the land considering the optimized use of the land, however bidder shall ensure to meet the desired power generation capacity in the allotted plot area. Bidder shall also ensure that no water ponding and flooding occurs in the low lying areas & effective drainage is provided in the whole plot area, in all kind of site levelling and grading or plant at natural topography schemes, bidders has to ensure to provide proper and effective drainage system. After performing the optimization of levels from the detailed site survey by the Contractor, the final formation level of the

plot in various areas shall be finalized. The area shall be suitably cut and filled to suit the layout requirement. The site levelling and grading scheme incorporating the above aspects shall be submitted to employer for approval.

Fill shall normally be made up of Cohesive Non swelling material capable of being compacted up to 95% Modified Proctor density. As far as possible the excavated material which is suitable for fill shall be used in project area itself. Waste material shall be disposed off in sites to be identified and arranged by contractor himself at his own cost. In case earth has to be borrowed from outside the plant boundary, the same shall be arranged by the Contractor himself. The slope at the edge of graded areas shall not be flatter than 1:1.5 (1 vertical to 1.5 horizontal) in cutting and 1:2 in filling. In case of fill by rock material, the same shall be done in line with relevant Indian Standard.

All buildings & transformer yard area shall be constructed in levelled area. No foundation shall be allowed on back filled soil and in that case the depth of foundations shall reach up to NGL. Final Level will be approved in detail engineering.

The slope protection measure shall be provided in case inter levelled patches level difference is more than 2.0m. Random rubble/boulder/stone pitching/concrete blocks etc. shall be provided for the slope protection for road side slope, storm water ditches/drainage, embankment slopes, inter levelled patches slopes etc. as per design requirements. Suitable sand erosion control measure shall be provided in case any sand dune falls inside the plot area. The same may be made with Random rubble/boulder/stone pitching/concrete blocks etc. Bidder shall also provide sufficient grass/bushes/trees cover on these dune.

5. FENCING OF THE PROJECT

Fencing of Transformer yard etc

The area of Control room and Transformer yard has to be protected from foreign ingress by Chain Link fencing with fence posts all along its periphery.

The galvanized chain link fence shall be of 3 mm dia (10 SWG), 50 x 50 mm mesh size confirming to IS 2721 (Zinc Coated -Medium).The height of fencing shall be min 2.5 m from free ground level (including height of barbed wire angle). Toe wall shall be provided between the fence posts all along the run of the fence with the foundation.

Above the chain link fence, three rows of ‘Steel Barbed Wire, A-1 IS 278’ shall be provided in the Half Y steel post. The reinforced barbed wire will be attached to angle iron posts vertical height 400 mm. All fence posts and stay post shall be 50X50X6 mm MS angles spaced at 3.0 meter c/c distance. All corner fence posts will have two stay posts in orthogonal directions. Concrete foundations for the angle iron posts and stays shall be provided. Other necessary fixtures required for erection of fencing such as cleats for eye bolts, eye bolt strainers, stretcher bars, droppers etc. shall be provided by the contractor as per standard engineering specifications. The complete design, materials and the erection of chain link fencing shall be done as per standard engineering specifications and the same shall be got approved by the owner before taking up erection.

The portion of the fence covering towards rail track shall be made of a removable type for movement of the transformer during erection /removal. In addition, a gate of 3 m and 1.2 m clear width shall be provided for entry in transformer yards. The fencing work shall conform to CEIG requirements. Transformer track rails shall conform to IS 3443.

Fencing of Solar Plant Peripheral Boundary

The complete project area has to be protected from foreign ingress by fencing all along its periphery. The Solar Plant Peripheral boundary includes providing either or combination of following:-

I. Pre-Stressed Precast Boundary Wall.
II. Chain Link Fencing for Boundary.

Pre Stressed Precast Boundary Wall

Pre stressed precast boundary wall shall be provided on the periphery of the complete solar plant. The complete periphery boundary works & gate shall be constructed by the bidder.

Bidder scope of work includes casting of pre-stressed precast boundary wall panels, columns etc. at bidder's facility/facility established by bidder at site/manufacturing unit, transportation of precast units at site and storage, excavation for casting of foundation and fixing of panels, construction of foundation, erection of columns to plumb & wall panels with required T&Ps, fixing of concertina with all items, backfilling etc. complete in all respect.

The bidder shall submit construction drawing for employer approval before manufacturing and execution at site. The construction drawing shall also incorporate suitable scheme to place precast boundary wherever there is changes in ground levels, corner, joint, water body crossings etc.

a) The total height of boundary wall shall be minimum 2850 mm above formation level (Finished ground level in case formation level is less than natural ground level). Upto height of 2000 mm, it shall be constructed with pre-stressed precast reinforced cement concrete panels fixed to groves made in pre-stressed precast reinforced cement concrete column and over that for 600mm spiral razor concertina coil with maximum loop spacing of 125mm shall be provided with Y-shaped MS angle.

b) The pre-stressed precast reinforced cement concrete columns shall be provided at spacing not more than 2200 mm c/c.

c) The pre-stressed precast reinforced cement concrete columns foundation shall be minimum 500 mm below finished formation level. The boundary wall panels shall be at least 100 mm below formation level. The boundary wall columns of minimum size 200 mmX150 mm shall be provided with two grooves of minimum size 55 mmX50 mm, so as to receive boundary wall panels spanning from column to column with minimum width of 300 mm and minimum thickness of 50 mm as filler wall.

d) The grade of concrete for all pre-stressed precast panels and column, etc. shall be of minimum M30 grade and Grade of foundation block shall be min M25 grade conforming to IS 456. The size of the foundation shall be decided based on the site conditions however the minimum diameter of the foundation shall not be less than 300 mm and depth not less than 500 mm.

e) The boundary wall column with GI angle Post (50x50x5 mm) including nut and bolt (As per IS 2062 and IS 4759) for 5 nos of GI Barbed wire made from 4 line wire,

each 2.5 mm thickness (As per IS 278) and galvanised concertina wire Bto-10 (Confirming to ASTM A 653) throughout the boundary wall shall be provided.

f) Opening for gates/drains and for other crossing has to be suitably provided as per the requirement/instructions of engineer in charge.

g) Bidder has to ensure that damages such as cracks and chipping off of corners do not happen during handling due to knocking etc. In case, such damages happen, the same has to be brought to the notice of engineer in charge.

h) In case the damage is minor, the same has to be made good using approved epoxy resin. Non shrink grout can be used for chipped off corners. No monetary claim shall however be admissible for such repairs. The engineer in charge reserves the right to accept or reject any damaged precast unit and the decision shall be binding on the bidder.

i) Suitable foundation and boundary wall arrangement with steel grating/grill shall be made in the boundary wall scheme to ensure intact wall/safety in the water body/drains entry and exit points in the plot area. The boundary wall shall be at sufficient height from water level. The toe wall for fencing at water body area shall be made of RCC only.

Chain Link Fencing for Boundary

a) The chain link fencing shall compromise of G.I chain link fencing with mesh size 75x75 mm with a nominal mesh size of 3.15 mm diameter. The chain link fencing material requirement shall conform to IS 2721. The chain link fence fabric shall have zinc coating of type 'Heavy' as given in IS 4826.

b) The G.I. chain link wire mesh will be stretched and attached by clips to 3 strands of High Tensile Spring Steel (HTSS) wire of 4 mm dia interwoven in chain link wire mesh and kept under tension which in turn are attached to the fence post with security nuts and bolts. On every fourth post a clamping strip will be threaded through the links of chain link and bolted to the fence post with the help of security nuts and bolts. All nuts, fasteners, bolts, clamping strips, clamps, clips, etc. shall be galvanized.

c) All bolts provided in the fence work shall be minimum 10 mm diameter. Length of all bolts shall be such that after fixing in position it shall have at least 10 mm projected length beyond the nut. All nuts & bolts shall be high quality as per BIS standard and heavy duty galvanized. The threads of projected length of the all bolts beyond nut after fixing in position shall be destroyed by hammering or by any suitable means to protect from any possible theft by miscreants.

d) Above the chain link fence three rows of 'Steel Barbed Wire, A-1 IS 278' shall be provided in the Half Y steel post at a maximum spacing of 175 mm c/c. The reinforced barbed wire will be attached to angle iron posts vertical height 400 mm. The type of section for fence shall be as mentioned in the fencing drawing and details of the scope of work of fencing in plot layouts.

e) All fence posts shall be 55X55X5 MS angles spaced at 3.0 meter c/c distance. All corner fence posts will have two stay posts in orthogonal directions and every tenth post will have a stay post in the direction of the fence. All stay posts shall be 55X55X5 MS angles. Concrete foundations for the angle iron posts and stays shall

be provided. Toe wall shall be provided between the fence posts all along the run of the fence with the foundation.

f) All MS angles and members used in posts shall also be galvanized in line with relevant code provisions.

g) Suitable foundation/fencing arrangement shall be made in the fencing scheme to ensure intact fencing/safety in the water body/drains entry and exit points in the plot area. The same may be provided with a grid of MS angles of 75X75X5 sizes with foundation.

The complete design, materials and the erection shall be done as per specifications and the same shall be got approved by the owner before taking up erection.

6. ENTRY GATES AND SECURITY CABIN/ GUARD ROOM

ENTRY GATES

The entry gates shall include one main gate and another wicket gate for pedestrians and one number Security cabin/Guard room adjacent to each wicket gate. The main gate shall be of overall size of 5m width by 3m height. The main gate panels shall be fabricated of mild steel frame and shall consist of two leaves of equal width with a steel plate of minimum 22 gauge welded to the steel frame and provided with required paint and accessories necessary for smooth operation of gate. The design of gate shall be submitted to the Owner for approval prior to its fabrication. The location and number of these gates shall be decided in consultation with owner during detailed engineering to meet site requirements.

SECURITY CABIN / GUARD ROOM:

Security/Guard room provided at entrance gate shall be of Pre-Fabricated type or brick masonry with RCC slab duly approved by the Owner. The size of security room shall be minimum 9 Sq Meter. In addition to this, a toilet including Indian type W/C, wash basin and other required accessories shall be provided with the security room. Toilet room shall be Pre-Fabricated type or made of brick masonry. All the necessary plumbing, sanitary lines and electrical connections for lighting and exhaust fan in toilet shall be provided. Specifications for flooring, roofing, painting etc. shall be same as those provided for Inverter room. All the details of Security/Guard room including toilet shall be got approved from the Owner before erection.

7. PATHWAYS AND ROADS

The approach road from main entrance gate of the Solar Plant to MCR building shall be 3.0 meter wide black top road with 500 mm wide shoulder on both sides. 20 mm thick premix carpet shall be laid for black topping. Red moorum/ brick, minimum 100 mm thick shall be provided for shoulder. The crown of the road shall be minimum 150 mm above FGL. The final finished roads shall have a camber of 1 in 50.
The approach roads connecting to all Inverter rooms, switchgear room etc. have the same specifications but without premix carpet at top.

The minimum road section shall be as follows:

1) Topping: Wearing course of premix carpet 20 mm thick.
2) WBM, compacted 75 mm thick (Grade-III).
3) WBM, compacted 100 mm thick (Grade-II).
4) Granular Sub-base, compacted 150mm thick granular sub-base (Gr-I).

5) Sub-grade under road and its shoulders shall be compacted to achieve 95% or more of standard proctor's MDD. CBR value of the sub grade level should be minimum 4%. If actual CBR is less than 4% in a particular stretch then GSB thickness shall be increased suitably.
Peripheral pathways other than approach road and road to MCR / inverter rooms/ Switchgear room shall be rolled WBM type with a carriage way of min 3 m width designed to facilitate movements to carry out daily maintenance.
The approach road upto other facilities shall be min. 3m wide and made of compacted moorum, gravels or earthen road.
Approach road design shall confirm to IRC.

The methodology of road construction with material specifications shall be submitted for approval before start of works.

8. STANDARDS

a) Basic and Layout design of the project shall be in accordance with internationally accepted practice. Appropriate IS Codes (latest version) shall be used wherever available. The Contractor should be able to provide various international and national references, when required by owner, to substantiate his design.

b) All structures for civil works shall be designed for severe combination of loads which shall also include but not limited to wind, seismic and load due to snow or tidal waves as the case may be.

c) The Contractor shall get the structural design done as per the relevant IS codes or international practices subject to the approval of the Owner. The structural design of all civil structures shall have to be proof checked by any reputed institution or any other consultant approved by the owner. The structural design shall have to be got approved from Owner, before actual start of the work.

9. CONSTRUCTION SPECIFICATIONS

The Contractor shall propose construction specifications for other civil works of the project unless provided otherwise in these specifications.

Details of Module mounting Structures including design, manufacturing, supply, assembly and installation and civil Foundation/ pilings, shall be submitted by contractor for approval.

Appropriate mounting structure to support the solar PV modules and to absorb & transfer the mechanical loads to the water body /ground needs to be designed.

These specifications shall be conforming to National / CPWD / State Government Specifications/Construction Practices for similar projects and shall be supported by International/National references when so required by the Owner. These specifications in the draft form shall be first discussed with the Owner before they are duly approved by the Owner for the execution.

10. MODULE CLEANING ARRANGEMENT

Bidder shall propose solar modules cleaning system made of a combination of dry cleaning system as well as cleaning with water through pipe network, or either of these two complete cleaning systems.

Solar Module Washing System with Water

1. Bidder shall provide permanent arrangement for module washing in the SPV Plant. This shall include installing one or more deep tube/bore wells with pump and motor, requisite storage arrangement and laying network of HDPE pipe conforming to IS 4984 and other relevant codes. The module washing shall be complete in all respect and the details shall conform to the relevant IS codes. The complete scheme shall be subject to approval of the owner including inputs points, design and drawings for the system. Opening from the HDPE pipe with manual isolating valves should be provided at regular intervals. The opening pipes for fixing the movable/Hose pipes for spraying water on module shall be made of GI pipe. Bidder shall install flow meter for measurement of water consumption.

2. Water for cleaning shall be arranged by contractor.

3. Design of solar PV module cleaning system shall be such that complete solar plant shall be cleaned with fresh water once in a month. Module cleaning system piping network shall be closed looped pipe network configuration consists of Main pipe, sub-main and branches. Module cleaning system piping network may be design for dead end/tree pipe network configuration. Minimum 3 tapping /washing point shall be functional at same time. Cut-off valves shall be provided at suitable junction point so that the repair works may be conducted at a particular area without disturbing the whole area. The water used for cleaning should be of appropriate quality fit for cleaning purpose as per the recommendations of module manufacturer.

4. Bidder shall provide the piping and the instrumentation diagram (P&ID) of water washing arrangement including the physical sequence of branches, reducers, valves, pressure gauge, cleaning points with location of pump(s) and water storage tanks to Employer for approval during detailed engineering.

5. The HDPE pipe shall be suitably protected against any impact load. The HDPE pipes shall be covered with higher diameter GI pipe at roads crossing for protection against any heavy loads etc. at roads section. The same protection shall also be provided wherever higher loads are expected. The bidder may also propose some other protection system for HDPE pipes.

6. These pipes shall be buried in ground by at least 150mm deep from NGL/FGL. Only in case of rock at surface and difficulty in cutting the surface rocks, pipe may be accepted at surface at some location. The same shall be subject to approval from the owner.

7. Maximum length of hose pipe shall be 50 meter from tapping point. Tapping point shall be place above PCC slab/block.

8. After laying and jointing, Testing of main pipe, service pipe and fitting shall be checked by charging with water. The test pressure shall be minimum 0.5 N/mm^2 or double the maximum working pressure, whichever is greater. The pressure shall be applied by means of a manually operated test pump, or, in the case of long mains or mains of a large diameter, by a power-driven test pump, provided the pump is not left unattended.

9. End of the branch pipes/tapping points to be bent horizontal/downward to avoid entry of foreign materials like, earth, sand leaf, gravels etc.

10. Bidder to ensure interconnection between the sub-systems of module washing system through isolating valve, so as module cleaning may be continued in case of outage of any sub-system.

11. Bidder shall ensure that the complete module washing system is integrated suitably with bore wells, check motor and water pipeline coming at the periphery of the plant.

The contractor shall also provide a water treatment plant at each source of water based on water quality. The treated water quality shall be suitable for washing of the Solar Modules. The details of the water treatment plant shall be submitted by the contractor to the owner for approval by the owner.

Supply and erection of necessary pumps, water-line and water tanks are in the scope of the Contractor. Contractor shall furnish calculations based on the head and discharge requirements of the pump rating and the water-line details. Contractor shall provide the single line diagram of water washing arrangement with location of pump to Owner for approval during detailed engineering.

Contractor shall also provide manual interconnecting valve to connect the water supply of one network to other to meet water requirement in case of outage of one pump.

Robotic Solar Module Cleaning System

The Module mounting structure/ table shall be designed and modelled considering connection details for robotic cleaning for travelling from one table to another. Crossing of overhead lines, cables through trays & pedestals, connecting approach road between the rows of MMS/Table in layouts shall be avoided for optimum use of robotic cleaning system.

Model of working shall be automatic cleaning, IP65 protection level, self-powered system with battery backup (without external supply), it should be compatibility & integrated with SCADA.

Bidder shall supply the complete robotic cleaning system at site as per approved Array/Plant layout drawings, and supervision of installation & commissioning by supplier along with owner O&M team, all other activities related to robotic cleaning including storage, loading, unloading, transportation within site, its supply including start end docking station, bridge material required complete in all aspect, nuts and bolts, fasteners, installation, coordination, commissioning and any other activity not specified herein but required for successful commissioning of robotic cleaning system is included in the scope of Bidder.

PUMP ROOM

Pump room shall be of RCC frame brick masonry structure. Dimensions of the pump room shall be minimum 3m x 3m with 9" x 9" RCC columns with GI/PVC sheet roofing. Necessary RCC foundation along with embedment suitable for pump shall be provided. The three side walls of the pump room shall be of brick masonry and on the remaining one side steel shutter gate shall be provided over the entire width and height of the room. The shutter gate shall be fabricated from 18 gauge steel and machine rolled with 75mm rolling centres with effective bridge depth of 12mm lath sections, interlocked with each other and ends locked with malleable cast iron clips to IS:2108

and shall be designed to withstand a wind load without excessive deflection. One additional normal door shall be provided on one side wall. Necessary electrical connections for lighting and exhaust fan in pump room shall be provided. Doors & Windows shall be suitably provided along with the ventilators. Specifications for flooring, plastering, white washing and painting etc. shall be same as those provided for main control room.

11. MAIN CONTROL ROOM

For the operation & maintenance of SPV Plant, Centralised Main Control Room shall be built. The Main control room shall be RCC framed structure with bricks/concrete blocks masonry walls. The Main Control Room shall have entry lobby and portico with roof for vehicle stoppage. It should also consist of 2 rooms with attached bath & toilet to serve the purpose of transit camp. These rooms can be constructed on the roof of the main control room.

Parking shed to accommodate at least 2 cars and 10 bikes shall be provided near the Centralised Main Control Room building. The parking shed shall be made of structural steel with permanently colour coated roof sheets.

The Centralised Main Control Room building shall comprise (but not limited to) of the following rooms. The minimum size & major requirements of each room shall also be as per the details given hereunder.

1) Air conditioned SCADA Room (Size Min 30 Sq Meter for projects upto 250 MW)
2) Battery Room, ACDB and 33 kV Switchgear Room

   (The room sizes shall be based on manufacturer recommendations, easy passage of O&M Persons and cable trench layout required. Minimum clearance between back side of any floor mounted panel and the wall shall be 850 MM or manufacturer recommendation whichever is higher. Minimum working clearance before front panels of any switchgear, PCU or similar equipment generally shall not be less than 2200 MM.
3) 02 no Air-conditioned Rooms for office along with office furniture.

   i) Office Room-1 (for Owner): Min Size 15 Sq Meter
   ii) Office Room-2: Min Size 15 Sq Meter
4) Air-conditioned Conference Room (Size Min 20 Sq Meter) alongwith a table of appropriate size, Min 10 no. of chairs, furnishings etc.
5) Record Room (Size Min 5 Sq Meter)
6) Store Room with sufficient no. of modular rack for proper identification and storage of tools & spares (Size Min 50 Sq Meter).
7) Toilets (Male and Female) (Total Size Min 12 Sq Meter)
8) Pantry (Size Min 4 Sq Meter)
9) First Aid Room (As per requirement/ norms)

The pantry shall consist of one number stainless steel pantry sink, as per IS : 13983, of size 610 x 510 mm, bowl depth 200 mm with drain board of at least 450 mm length with trap, with inlet and outlet connections and good quality concealed water supply pipe of minimum 12 mm dia of medium class, sanitary pipe of minimum 75 mm diameter, floor trap with Stainless Steel grating, inlet and outlet connections for supply and drainage, with all bends, tees, junctions, sockets, etc., as are necessary for the

commissioning and efficient functioning of the pantry (all sanitary fittings shall be heavy duty chrome plated brass, unless specified otherwise)

In addition, Contractor shall construct at least one security room of size minimum 3m x minimum 3m near the entry gate of main control room with toilet and water facility as specified in Clause 6 above.

One Store shed (in addition to all other stores), with Min size - 100 sq.m (for projects upto 250 MW) shall be also be constructed near Centralised Main Control Room for storage of Mandatory/specified spares during O&M Period by bidders and later on for Employer after O&M period. The Store shed shall be a Pre Engineered Building with framed structure. The design and drawing of the store shed shall be submitted for Employer approval before start of work.

The Contractor is required to submit the proposed drawing of Main Control Room during detail engineering to the owner for approval.

The buildings and allied works shall be designed to meet NATIONAL BUILDING CODE (SP: 07 2016) requirements. Finish floor level of all building/rooms shall be minimum 450 mm above the Finish graded level.

For enclosing the Air conditioned SCADA room, partition consisting of anodised aluminium extrusion and glazing (or Novopan board) shall be provided. Split AC Units shall be provided as per the details mentioned in SCADA Chapter of E & M Specification.

The SCADA room, Office Room and Conference Room shall be provided with false ceiling of 15 mm thick mineral fiber board, in tile form of size 600mm x 600mm, along with galvanized light gauge rolled form supporting system in double web construction pre painted with steel capping, of approved shade and colour, to give grid of maximum size of 1200x600 mm as per manufacturers details including supporting grid system, expansion fasteners for suspension arrangement from RCC, providing openings for AC ducts(if required), return air grills(if required), light fixtures, etc., all complete.

The details of AC units, furniture, furnishing etc for office rooms, conference room, SCADA Room and at other places for operator/ other personnel (if required) shall be proposed for the approval of the Owner and same shall be provided by the Contractor.

11.1. RCC WORKS

All RCC works shall be carried out with design mix as per IS: 456-2000. For structural concrete items, Ordinary Portland Cement (43/53 Grade) conforming to IS: 8112-2013/ IS: 12269-1987 shall be used. Type of cement for sub-structures shall be decided based on the final soil investigation report.

Coarse aggregate for concrete shall be crushed stones chemically inert, hard, strong, durable against weathering of limited porosity and free from deleterious materials. It shall be properly graded. It shall meet the requirements of IS: 383.

Sand shall be hard, durable, clean and free from adherent coatings of organic matter and clay balls or pellets. Sand, when used as fine aggregate in concrete shall conform to IS 383. For plaster, it shall conform to IS: 1542 and for masonry work to IS: 2116.

Reinforcement steel shall be of high strength deformed TMT steel bars of grade minimum Fe-415 and shall conform to IS: 1786. Ductile detailing in accordance with IS: 13920 shall be adopted for superstructure and substructure of all RCC buildings / structures.

The following minimum grades of concrete for design mix and nominal mix shall be adopted for the type of structures noted each unless not specified elsewhere.

M-30	All RCC structural elements above and below ground level, precast concrete, MMS foundation, cable trench, oil pit, Grade Slab, Paving, culverts & road. All RCC structural elements above and below ground level. RCC cable trench, oil pit, Grade slab, Foundations for other misc. components, Auxiliary Transformers etc.
M-20 (Equivalent nominal Mix of 1:1.5:3)*	Fencing work
M-20 (Equivalent nominal mix of 1:2:4)	Base slab of drains
M-20 (Equivalent nominal mix of 1:3:6)	Plain Concrete Cement

*The use of nominal mix for M-20 grade may be accepted only in exceptional cases subject to approval of Employer Engineer-In-Charge. The same shall be then adopted subject to approval from employer for specific work.

The bidder shall carry out the design mix of M-30 and M-20 grade concrete on priority. The design mix shall be approved from employer before start of work.

In case Geotechnical investigations requires any special kind of cement or higher grade of concrete, the same shall be provided. All foundation system and foundation depth shall be decided based on the approved geotechnical investigation report.

All loads shall be considered in line with IS: 875. Seismic loads for design shall be in accordance with IS: 1893 and relevant standards.

IS: 2502 Code of Practice for Bending and Fixing of bars for concrete Reinforcement must be complied for reinforcement. IS: 5525 and SP:34 shall be followed for reinforcement detailing.

A minimum of 75 mm thick PCC shall be provided below RCC wherever RCC is laid over the ground. Proper and sufficient formwork/shuttering shall be provided for the required period as per IS: 456.

Grouting

Cement mortar (1:2) grout with non-shrink additives shall be used for grouting below base plate of a column. The grout shall be high strength grout having a minimum characteristic compressive strength of min 30 N/mm^2 at 28 days.

11.2. MASONRY WORK

All brick works (If proposed anywhere) shall be using at least Class designation 7.5 of approved quality as per IS: 1077, IS: 2212 and IS: 3495. The cement mortar for brick masonry shall be in the ratio 1 cement and 6 sand by weight. The cement mortar shall

be machine mixed. Bricks required for masonry work shall be thoroughly soaked in clean water tank for approximately two hours before their actual use. Brick shall be laid in English bond style. Green masonry work shall be protected from rain. Masonry work shall be kept moist on all the exposed faces for a period of seven days from the day of execution.

11.3. DOORS,WINDOWS, VENTILATORS AND ROLLING SHUTTERS

Doors, windows and ventilators of air-conditioned areas, entrance lobby of all buildings, and all windows and ventilators of MCR building shall have, powder coated (minimum thickness of powder coating 50 micron) aluminium framework with glazing. Window shall be provided with suitable aluminium grill. Ventilators/duct shall be provided with bird guard.

Doors of toilet areas shall be of steel framed solid core flush shutter as per IS 2202. Minimum size of door provided shall be 2.1 m high and 1.2 m wide. However, for toilets and office minimum width shall be 0.75 m and 1.2 m respectively.

The Bidder can also propose uPVC extruded casement/ sliding windows and doors with complete fitting and accessories as per items mentioned in DSR 2016. All external doors of MCR shall be provided with Collapsible metal grille with locking system.

Doors and windows on external walls of the buildings (other than areas provided, with insulated metal claddings) shall be provided with RCC sunshade over the openings with 300 mm projection on both side of the openings. Projection of sunshade from the wall shall be minimum 450 mm over window openings and 450 mm over door openings except for main entrance door to the control room where the projection shall be 1500 mm.

Rolling shutter (Mechanical gear operated) shall be fabricated from 18-gauge steel and machine rolled with 75 mm rolling centres with effective bridge depth of 12 mm lath sections, interlocked with each other and ends locked with malleable cast iron clips conforming to IS: 2108 and shall be designed to withstand a wind load without excessive deflection. Metal rolling shutters and rolling grills as per IS: 6248.

11.4. GLAZING

All accessible ventilators and windows of all buildings shall be provided with min. 4mm thick float glass, plain or tinted for preventing solar radiations, unless otherwise specified.

For single glazed aluminium partitions and doors, float glass of 8mm or 10 mm thickness shall be used.

The glass to be used should be from the reputed manufacturers of glass like Glavebel (Belgium), Saint Gobain (France) or Fort (USA) or equivalent. The glass should be free from distortion and thermal stress.

11.5. PLASTERING

All external surfaces if any shall have 15 mm cement plaster in single coat 1:4 with water proofing compound. After plastering white cement primer shall be provided.

At least one coat of plaster shall be applied to interior walls by hand or mechanically, to a total thickness of 12 mm using 1:6 mortar. Plastering shall comply to IS: 1542, IS:1661, IS:1630. Oil bound washable distemper on smooth surface applied with 2 mm thick Plaster of Paris putty for control room.

Plaster of Paris (Gypsum Anhydrous) conforming to IS: 2547 shall be used for plaster of Paris punning. All the material used for water proofing, distempering and Plaster of Paris shall be got approved from Owner before purchase.

11.6. FLOORING

The Cement shall be PPC as per relevant BIS/IS codes.

Flooring for all air conditioned areas and offices area shall be provided with vitrified ceramic tiles of size 600X 600 mm of min 9 mm thickness, laid with 3 mm ground joints as per approved pattern, painted neatly with 3X4 mm stainless epoxy grout or equivalent

Flooring for stores, security cabin shall be of cement concrete flooring as per IS: 2571.

Heavy duty (Grade V) dust pressed ceramic tiles (300X 300 mm) as per IS: 13755, shall be provided for flooring of toilets and pantries. Acid resistance tiles shall be used for battery room.

For pantry slab floor mirror polished (6 layers of polish) Granite stone (slab) of minimum thickness of 18 mm shall be used.

11.7. ROOFING

Roof of the main control room Building shall consist of Cast-in-situ RCC slab treated with a water proofing system which shall be integral cement based treatment conforming to CPWD specification (item no. 25.8 of DSR 1997 or equivalent in latest version of DSR). The roof of the building shall be water proof with tarfelt 5 layer over screeding. The roof shall be designed for a minimum superimposed load of 150 kg/sq.m.

For efficient disposal of rainwater, the runoff gradient for the roof shall not be less than 1: 100 and the roof shall be provided with RCC water gutter, wherever required. Gutter shall be made water tight using suitable watertight treatment. This gradient can be provided either in structure or subsequently by screed concrete M25A 12.5 and/or Cement mortar (1:4). However, minimum 25 mm thick cement mortar (1:4) shall be provided on top to achieve smooth surface.

The roof of the main control room shall be projecting out by at least 900mm all around the main control room building for protection of its external walls from rain water.

11.8. PAINTING OF WALLS & CEILINGS

INTERNAL WALL SURFACES: SCADA ROOM & CONFERENCE ROOM ALL OTHER ROOMS IN PLANT BUILDINGS	-ACRYLIC EMULSION -ACRYLIC DISTEMPER
EXTERNAL FACES OF WALLS:	-EXTERIOR EMULSION PAINT
WALLS OF BATTERY ROOM	-ACID ALKALI RESISTANT PAINT, AN EXPOSED WALL ABOVE DADO -2100

	MM HIGH DADO OF ACID ALKALI RESISTANT TILING
ALL CEILING	-ACRYLIC DISTEMPER

The paint shall be anti-fungal quality of reputed brand suitable for masonry. All painting on masonry or concrete surface shall preferably be applied by roller. If applied by brush, then same shall be finished off with roller. For painting on concrete, masonry and plastered surface, IS: 2395 shall be followed. Minimum 2 finishing coats of paint shall be applied over a coat of primer.

For painting on steel work and ferrous metals, BS: 5493 and IS: 1477 shall be followed. The type of surface preparation, thickness and type of primer, intermediate and finishing paint shall be according to the painting system adopted.

Ceiling of all rooms except Battery room shall be white washed. The ceiling of Battery room (if provided) shall be acid/alkali resistant paint. Centralised MCR building outside colors of paining shall be similar to PEB painting colours.

A standard color scheme for the different buildings/structures shall be prepared by the Contractor and the approval of the Owner shall be obtained, before commencement of work.

11.9. PLINTH PROTECTION

Plinth protection shall be provided around all the buildings.

11.10. WATER SUPPLY

Good quality pipes as per standard practice shall be used for all water supply and plumbing works.

The Syntax or equivalent make PVC storage water storage tank(s) conforming to IS:12701 shall be provided with minimum capacity 2500 liters, complete with all fitting including float valve, stop cock etc.

Required water connection to service the main control room shall be in the scope of the Contractor. Contractor shall furnish calculations based on the head and discharge requirements of the pump rating and the water-line details for approval by the Owner. The water samples obtained shall be tested at Owners approved laboratory and reports shall be furnished.

11.11. PLUMBING AND SANITARY

Each toilet shall have the following minimum fittings:-

(a) WC (Western type) 390 mm high with toilet paper roll holder and all fittings or WC (Indian Type) with all fittings (both types of WCs shall be provided at alternate locations).
(b) Urinal (430 x 260 x 350 mm size) with necessary C.P fittings.
(c) Wash basin (550 x 400 mm) with all fittings.
(d) Bathroom mirror (600 x 450 x 6 mm thick) hard board backing
(e) CP brass towel rail (600 x 20 mm) with C.P. brass brackets
(f) Soap holder and liquid soap dispenser

All fittings, fastener, grating shall be chromium plated. Necessary plumbing lines shall be provided for main control room building and Security cabin.

Wash basin provision for hand wash shall also be provided in battery room.

The Contractor shall design & provide underground one septic tank and two soak pits and assuming that a total of 20 No. personnel shall be working for the plant during O&M stage in combined two shifts. The waste water/effluents from the sewerage plants/septic tank shall meet the state pollution board requirement

11.12. ELECTRIFICATION OF BUILDING

Electrification of building shall be carried out by the Contractor as per the details mentioned elsewhere in technical specification and the same shall be as per IS: 732, IS: 4648 and other relevant standards.

11.13. STAIRS

To access the roof of MCR for maintenance of communication equipment and water tank, suitable RCC half landing staircase as per relevant BIS codes shall be provided. MCR building RCC terrace of Centralised MCR building shall also work as view point. View point shall be used for security purposes and viewing gallery.

11.14. FALSE CEILING

The Control Room, Conference Room, Server & SCADA Room and Office Rooms of the Main Control Room building shall be provided with false ceiling of 15 mm thick mineral fibre board, in tile form of size 600mm x 600mm, along with galvanised light gauge rolled form supporting system in double web construction pre painted with steel capping, of approved shade and colour, to give grid of maximum size of 1200x600 mm as per manufacturers details including supporting grid system, expansion fasteners for suspension arrangement from RCC, providing openings for AC ducts(if required), return air grills(if required), light fixtures, etc., all complete.

11.15. LIGHTING

The lighting design of the main control room building shall be carried out as per IS 3646. The average illumination level of control room shall be 300 Lux with Mirror optics with anti-glare type or Decorative Mirror optics type of fixture. The building shall be provided with adequate light fittings, 5A/ 15A 1 phase sockets, fans etc. controlled by required ratings of MCBs and MCB DBs. All MCBs / Isolators shall be mounted inside the panel and a bakelite/fibre glass sheet shall be provided inside such that operating knobs project out of it for safe operation against accidental contact. Operating handle of incoming MCCB/isolator shall project out of door. Wiring inside the panel shall be carried out with 1100V grade PVC insulated stranded copper conductors of adequate size.

Supply and providing of suitable illumination along the peripheral roads, control room, inverter rooms and other facilities like outside main control room etc. inside the plant shall be done by the Contractor as per relevant BIS Codes and as per other technical Electrical Specifications of this contract.

12. INVERTER ROOM

Inverter rooms consist of PCU's, LT panels, batteries, etc. shall be provided based on manufacturer recommendation, easy passage of O&M persons and cable trench layout required.

The inverter rooms may be made of Pre Engineered Building (PEB) in line with PEB technical specification mentioned below or with RCC structure for buildings and containerized solutions.

The battery and its associated equipment shall be suitably segregated inside the Inverter room with proper ventilation arrangement.

The Inverter Room shall be made of Pre-Engineered Buildings (PEB). The PEB shall be made of structural steel construction with double skinned metal roofing and wall cladding of approved profile. It shall be designed, manufactured, supplied and erected by the bidder/PEB agency. PEB shall be complete with painting, metal facia, metal gutter, rain water down comers, sun-shades, openings, etc., along with associated structural steel, cladding and roofing work insulation, Trims & Flashings. Each item of PEB like panels, masonry, plastering, flooring, foundation, fittings etc. shall be suitable for complete life of solar plant. The construction methodology for PEB shall also be submitted for approval before start of works.

The layout of Inverter room shall be designed so as to divert the heat generated from each inverter outside the room. The inverter room shall be designed for a life of 25 years. The PEB shall have robust water tightness at all joints and connections. The building shall have a high class durability and performance during the adverse weather conditions. The PEB supplied shall be complete in all respect meeting all the requirements and other technical and functional requirements like lighting, ventilations system etc. to ensure effective functioning. The PEB shall have robust water tightness at all joints and connections. The building shall have a high class durability and performance during the adverse weather conditions.

The area and number of inverter rooms required shall be proposed and submitted by the contractor for approval of the owner. The structural design shall have to be got approved from Owner, before actual start of the work.

12.1. STRUCTURE AND MATERIAL SPECIFICATION

The PEB inverter room shall have steel frame primary structural members. All hot rolled primary structural members and Rod/Angle/Pipe bracing etc. shall conform to IS: 2062, minimum Grade E250 Quality A. Secondary members for Purlins and Girts shall conform to the specification of IS 811 or ASTM A1003-12 made from steel sheets conforming to ASTM A1011-12b Grade 50 having a minimum yield strength of 345 MPa. The minimum thickness of secondary members shall be 3mm. All other miscellaneous secondary members shall have minimum yield strength of 250 MPa.

Insulated wall cladding or roofing shall consist of double skin metal cladding with Poly Urethane Foam (PUF). PUF must be made of continuous method PU foam and must be CFC free, self-extinguishing, fire retardant type with density 40 +/-2 kg/m3 and thermal conductivity 0.019-2.2 W/(m.K) at 10°C. The PUF panels shall be a factory made item ready for installation at site.

12.2. FASTENERS & CONNECTIONS

Special coated self-drilling screws/fastener shall be used conforming to class 3 as per AS: 3566.1 and AS: 3566.2. Steel bolts, nuts and washers complying with AS 1112:2000. High Strength Bolts for Primary Connections shall be as per IS: 1367 (Part

III) Gr. 8.8 /ASTM A325. Bolts for Secondary Connection shall be as per IS: 1367 (Part III) Gr. 4.6 /ASTM A307. Anchor/foundation Bolts shall conform to IS: 5624 and relevant IS code.

12.3. ROOF AND WALL CLADDING

PUF panels shall be made of troughed permanently colour coated metal sheets of steel for roofing and side cladding (internal and external) shall conform to the requirements of Table-I and IS: 513 for Hot-dip Zinc coated or Al/Zn coated sheets. The insulation material thickness and details shall be as specified at relevant para in the specification.

PUF insulated panels Metal Sheet for Roofing and side cladding consist of external sheet as troughed permanently colour coated sheet & internal sheet as plain permanently colour coated sheet.

Chemical composition of Troughed permanently colour metal sheet for roofing and side cladding shall conform to the provisions of same reference code to which the mechanical properties conform to.

Plain permanently colour coated steel metal sheet for ridge and hips, flashing, trimming, closure for vertical and horizontal joints, capping etc. shall conform to the same requirements as those of troughed permanently colour coated metal sheet for roof and side cladding.

The maximum spacing of the fastener shall be 390 mm c/c along the length of purlins /runners. However exact spacing shall be as per the design done by the bidder of the fastener considering the wind load, self-load and other associated load. Minimum diameter of the fastener shall be 5.5 mm and at-lest 3 nos. of fastener shall be used per sheet.

Fillers blocks as a trough filler shall be used to seal cavities formed between the profiled sheet and the support or flashing. The fillers blocks shall be manufactured from black synthetic rubber or any other material approved by owner.

12.4. ROOF INSULATION AND TYPE

Both metal sheets shall have an under insulation of minimum 40 mm thick PUF with density 40 +/- kg/m3 and thermal conductivity 0.019-2.2 W/(m.K) at 10°C with gutters and down take pipes along with Flashing &Top cap of required size and colour complete with all necessary hardware complete. Roof shall be projected at-least 300 mm from the wall. Stiffening ribs / subtle fluting for effective water shedding and special male / female ends with full return legs on side laps for purlin support and anti-capillary flute in side lap.

Both upper and lower sheets shall be separated through spacers and fastened through zinc/zinc-tin coated self-drilling screws. The fastener size shall be calculated as per the design or manufacturers recommendations.

12.5. WALL INSULATION

All voids of external and internal metalled walls shall have an under insulation of minimum 40 mm thick PUF with density 40+/- kg/m3 and thermal conductivity 0.019-2.2 W/(m.K) at 10°C with proper supports etc. as approved. Both the walls should be separated by spacers system made up of cold formed steel bars and fastened through

zinc /zinc-tin coated self-drilling screws. The external wall of Inverter room facing the transformer area shall be as per IS: 1646 - Code of practice for fire safety of buildings (general): electrical installations.

12.6. DOORS FRAMES

Door frames shall be of iron frame of mild steel sections. All doors shall be provided necessary fittings like hinges, handles, mortice locks, tower bolts, stopper, hydraulic door closer, etc. of CP brass complete fixed to Pre-Engineered structure including necessary filling up of gaps at junctions with required PVC/neoprene felt etc. including hinges / pivots and double action hydraulic floor spring of approved brand and manufacture IS: 6315 marked, lock, handle and all necessary fittings as detailed in tender drawing or submitted by bidder in shop drawing and approved by Employer.

The door entrance shall include Mild Steel single leaf door. The structural steel shall conform to IS: 7452 and IS: 2062. The holdfasts shall be made from steel flats (50 mm and 5 mm thick). The fixtures, fastenings and door latch are to be made with same materials

Bidder can also proposed uPVC extruded casement/ sliding doors, with complete fitting, accessories and panels as per items mentioned in DSR 2016.

12.7. WINDOWS FRAME

Aluminium black powder coated section, frame shall be of 92x31 mm, minimum 16G thick as per approved design. Tinted glass and aluminium grill shall be provided. The Bidder can also propose uPVC extruded casement/ sliding windows with complete fitting and accessories as per items mentioned in DSR 2016.

12.8. VENTILATORS

Aluminium black powder coated frame of minimum size 62x25 mm and 16G thick as per approved design. Ventilators/duct shall be provided with bird guard. Size of opening at wall for ducts shall be as per PCU manufacture and min 18 gauge GI sheet. Ducts shall be supported with suitable means, as approved during detail engineering.

All accessible ventilators and windows of all buildings shall be provided with min. 4mm thick float glass, tinted for preventing solar radiations. Suitable sunshades made out of approved colour sheet will be provided to all external windows and door. The minimum projection for the sunshades will be 450 mm and 300mm wider than the width of the opening.

12.9. PLINTH PROTECTION

500 wide plinth protection minimum 75 mm thick of cement concrete 1:3:6 (1cement : 3 coarse sand : 6 graded stone aggregate 20 mm nominal size) over 75 mm bed of dry brick ballast 40 mm nominal size well rammed and consolidated and grouted with fine sand including finishing the top smooth, shall be provided around the Pre-Engineered Building.

12.10. FLOOR FINISH

Flooring, including preparation of surface, cleaning etc shall be of cement concrete flooring as per IS: 2571 with ironite hardener. The inverter room floor shall be atleast 45 cm above the ground level.

12.11. PAINT AND COATING

Metal sheet shall be colour coated with total coating thickness of 25 microns (nominal) dry film thickness (DFT) comprising of silicon modified polyester (SMP with silicon content of 30% to 50 %) paint or Super Durable Polyester (XRW) paint of 20

microns (nominal) on one side (exposed face) on 5 micron (nominal) primer coat and 10 microns (nominal) SMP or Super Durable Polyester paint over 5 micron (nominal) primer coat on other side. SMP and polyester paints system shall conform to Product type 4 as per AS/ANZ 2728.The structural steel shall be hot-dipped galvanized, conform to IS: 4759 or relevant Indian standard.

12.12. DESCRIPTIONS OF PEB STRUCTURES

Primary Members: Primary structural framing shall include the transverse rigid frames, columns, corner columns, end wall wind columns, beams, truss member, base pate.

Secondary Members: Secondary structural framing shall include the purlins, girts, eave struts, bracing, flange bracing, base angles, clips, flashings and other miscellaneous structural parts. Suitable wind bracings sag rods to be reckoned while designing the structure.

Sealant: Sealant used for cladding shall be butyl based, two parts poly sulphide or equivalent approved, non-staining material and be flexible enough not to interface with fit of the sheets.

Closures: Solid or closed cell closures matching the profiles of the panel shall be installed along the eaves, rake and other locations

Flashing and Trim: Flashing and / or trim shall be furnished at the rake, corners, eaves, and framed openings and wherever necessary to provide weather tightness and finished appearance. Colour shall be matching with the colour of wall. Material shall be 26 gauge thick conforming to the physical specifications of sheeting.

Gutters and Down Comers: Gutters shall be fabricated out of same metal sheet. Material shall be same as that of sheeting. Down comers shall be of galvanised steel pipes or PVC designed to ensure proper roof drainage system.

Group	Grade/ Reference code	Yield strength (minimum) MPa	Tensile strength (minimum) MPa	Coating Class Designation	BMT (mm)	(+) ve Tolerance (mm)	Upper limit of BMT (mm)	(-) ve Tolerance (mm)	Lower Limit of BMT (mm)
I	G250/ AS1397	250	320	Z275	0.6	.04	.64	-.04	0.56
	SS255/A STM A653M	255	360						

	S250GD/ EN10326	250	330						
II	G350/ AS1397	350	420	Z150	0.5	.04	.54	-.04	0.46
	SS340 Class4/A STM A 792M	340	410						
	S350GD/ EN10326	350	420						
Note		Minimum elongation % shall be as relevant standard and code.							

All steel materials supplied by the agency shall be in a sound condition, of recent manufacture, free from defects, loose mill scale, slag intrusions, laminations, pitting, flaky, rust, etc. and be of full weight and thickness specified.

12.13. LIGHTING

The inverter room shall be provided with electric light to achieve proper illumination level as per standard. However room should be designed to utilise maximum natural light during the day. The Electrical Specifications in this contract shall be followed for Electrical works.

13. CABLE TRENCHES

In Main Control room, Inverter rooms & Transformer yard area, cables shall be laid in concrete cable trenches on ground. Cable trenches of suitable dimensions with GI cable trays shall be provided. The trench cover in Main Control room and Inverter rooms shall be of steel grating type. RCC Outdoor Cable Trenches in Transformer yard shall be provided with pre-cast RCC removable covers with lifting arrangement, edge protected with suitable galvanized angle iron designed to withstand self-weight of top slab + concentrated load of 150 kg at centre of span on each panel.

All other cables in the project area shall be buried cables with a provision for culvert/Hume pipe for protection of cables under the motorable roads. The details of buried cables are provided in the Electrical Specifications in this contract and the same shall be followed.

14. DRAINAGE SYSTEM

Drainage philosophy based on site area levels and invert levels of drains shall be developed and document/drawings for the same shall be submitted. Contractor shall design and construct suitable drainage system for rain & storm water. Also, cross drainages shall be designed and constructed by contractor after approval of respective drawings by the Owner. The drainage system shall consist of unlined drains. The Excavation of foundation trenches/Drains shall be done by mechanical means (Hydraulic excavator)/manual means depending on size of drain. The drains shall be of trapezoidal sections and shall be designed as per site rainfall data and other standard criteria. The construction shall include dressing of sides and ramming of

bottoms including mucking of the excavated soil and disposal of surplus excavated soil as directed by the owner.
The connection of the drains of solar plant area to the main drainage system of Solar park shall be done by the contractor.

15. TRANSFORMER YARD CIVIL WORKS

Transformer and equipment's foundations shall be founded on piles/isolated spread footings depending on the final geotechnical investigation report. Transformer foundations shall have its own pit which would cover the area of the transformer and cooler banks, so as to collect any spillage of oil or oil drainage in case of emergency. The area around the equipments shall be covered with gravel. The oil pit shall be provided with grating covers and gravel of 40-60 mm size uniformly graded shall be filled over grating cover. The individual oil pits shall be connected to an oil collection pit which shall be sized to accommodate oil volume of the transformer connected to it, without backflow. The oil pit shall be connected to oily water drainage system. Dimensions of the discharge pipe shall consider rainfall intensity also. The water shall be discharged into the nearest drain by gravity flow or pumping.

Transformer track rails shall confirm to IS: 3443. The requirement of fire barrier wall between transformers shall be as per Electricity Rules and IS: 1646 recommendations.

16. MODULE MOUNTING STRUCTURE

SCOPE

This section covers activities related to Design, Manufacturing, Testing, Supply, Insurance, Transportation, Delivery at project site, Storage, Erection, testing of module mounting structure and all other items required to furnish and install a complete ground mounting structural system which constitutes a photovoltaic array(s).

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	IS 800: 2007	Code of practice for general construction of steel
2	IS 875: 1987	Code of Practice for Design Loads (Other Than Earthquake) For Buildings And Structure.
3	IS 1893: 2002	Criteria for Earthquake resistant design of structures – General Provisions and buildings
4	IS 513: 2008	Cold-reduced low carbon steel sheets and strips.
5	IS 3043: 1987	Code of Practice for Earthing

TECHNICAL REQUIREMENTS

MODULE MOUNTING STRUCTURE

a) The array structure shall be so designed 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 aluminum (aluminum alloys)/ SS 304 or SS of better grade, of suitable thickness size. (Same to be confirmed by suitable test report & material composition report) having sufficient strength and suitable size to mount / support all the PV panels / 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 of the zone as defined in IS:875 Part III. (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 in the zone as defined in IS:875 Part III.

f) In general bolts, nuts, shims and other hardware should be zinc plated. Fasteners visible outside shall be of stainless steel SS304. The generally applicable engineering principle will be that fasteners shall be equal to or of greater corrosion resistance than the most corrosion resistance metals being fastened.

g) The other requirement/ specifications shall be as per Chapter of Module Mounting Structure of E&M Specification/technical requirements.

17. QUALITY ASSURANCE AND INSPECTION FOR CIVIL WORKS

The Contractor shall establish, equip and operate a comprehensive quality assurance set up at the site during the full period of execution of the works. The principal responsibilities and duties of this set up shall be to ensure that all works carried out and materials produced or supplied by the Contractor comply fully with the specifications.

To meet with the objectives of the specifications and quality assurance, the Contractor shall provide for execution of works experienced supervisory staff, trained workman, work procedures, equipments and involvement of such specialist support from construction industry as required for correct execution.

Quality of work in progress shall be reviewed once in a month in the quality assurance meeting specially called by the owner and participated by the Contractor's organization.

In addition to the requirement of experienced manpower for the works, Contractor shall also provide for quality assurance staff both for the field testing and for the laboratory.

17.1 GENERAL

This part of the specification covers the sampling, testing and quality assurance requirement (including construction tolerances and acceptance criteria) for all civil and structural works covered in this specification.

This part of the technical specification shall be read in conjunction with other parts of the technical specifications, general technical requirements & erection conditions of the contract which covers common QA requirements. Wherever IS code or standards have been referred they shall be the latest revisions.

The rate for respective items of work or price shall include the cost for all works, activities, equipment, instrument, personnel, material etc. whatsoever associated to comply with sampling, testing and quality assurance requirement including construction tolerances and acceptance criteria and as specified in subsequent clauses of this part of the technical specifications. The QA and QC activities in all respects as specified in the technical specifications/ drawings / data sheets / quality plans / contract documents shall be carried out at no extra cost to the owner.

The Contractor shall prepare detailed construction and erection methodology scheme which shall be compatible to the requirements of the desired progress of work execution, quality measures, prior approvals if any and the same shall be got approved by the Engineer. If required, work methodology may be revised/ reviewed by the Contractor at no extra cost to the Owner at every stage of execution of work at site, to suit the site conditions.

17.2 QA AND QC MANPOWER

The Contractor shall nominate one overall QA coordinator for the contract detailing the name, designation, contact details and address at the time of post bid discussions. All correspondence related to Quality Assurance shall be addressed by the Contractor's QA coordinator to Owner. Owner shall address all correspondence related to Quality issues to the Contractor's QA coordinator. The Contractor's QA coordinator shall be responsible for co-ordination of Quality activities between various divisions of the Contractor and their sub-vendors on one hand & with Owner on the other hand.

The Contractor shall appoint a dedicated, experienced and competent QA&QC in-charge at site, preferably directly reporting to the Project Manager, supported as necessary by experienced personnel, to ensure the effective implementation of the approved QAP. The Contractor shall finalize and submit a deployment schedule of QA&QC personnel along with their details to Owner for approval/ acceptance and further shall ensure their availability well before the start of the concerned activity.

17.3 SAMPLING AND TESTING OF CONSTRUCTION MATERIALS

The method of sampling for testing of construction materials and work / job samples shall be as per the relevant IS / standards / codes and in line with the requirements of the technical specifications / quality plans. All samples shall be jointly drawn, signed and sealed wherever required, by the Contractor and the engineer or his authorized representative.

The Contractor shall carry out testing in accordance with the relevant IS / standards / codes and in line with the requirements of the technical specifications / quality plans. Where no specific testing procedure is mentioned, the tests shall be carried out as per the best prevalent engineering practices and to the directions by the Engineer or his authorised representative. All testing shall be done in the presence of the engineer or his authorized representative in a NABL accredited / Govt. Laboratory acceptable to Owner. This includes all IITs, NCB, CSMRS, reputed government / autonomous laboratories / organizations, NITs and other reputed testing laboratories. The test samples for such test shall be jointly selected and sealed by the engineer and contractor and thereafter these shall be sent to the concerned laboratory through the

covering letter signed by Owner's engineer. The test report along with the recommendations shall be obtained from the laboratories without delay and submitted to Owner.

17.4 PURCHASE AND SERVICE

Structural steel supply which is in the scope of the contractor shall be procured from reputed steel producers like SAIL, TISCO, IISCO, RINL, ESSAR STEEL, ISPAT INDUSTRIES, JSW STEEL, LLOYDS STEEL, and JINDAL STEEL & POWER. In case of non-availability of some of the sections with main steel producers, the contractor may propose to procure the sections from the re-rollers of the main steel producers, the name of such re-rollers will have to be necessarily cleared by corporate quality assurance with owner. all details such as BIS approval, main steel· producer's approval, past experience for production of sections of specified material, details of machines plants testing facilities etc. shall be submitted by the contractor to facilitate such approval by owner. Confirmation that the process control and manufacturing of steel sections by re-rollers shall be the same as that of main steel producers that billets for re-rolling will be sourced from main steel producers only, shall also be furnished to the Owner with regard to re-roller.

Even after clearance of re-rollers, induction of billets with identified and correlated Mill test certificates (TC's) in the process of re-rolling, sampling of steel, quality checks thereof and stamping of final product for further identification and correlation with TC's prior to dispatch shall be the responsibility of the Contractor and these shall be performed in presence of the authorized representative of the Contractor.

17.5 FIELD QUALITY PLAN

Well before actual start of the work, the Contractor shall prepare and submit the Field Quality Plans (FQP) and obtain approval of Owner, which shall detail out for all the works, equipments, services, quality practices and procedures etc in line with the requirement of the technical specifications to be followed by the Contractor at site. This FQP shall cover all the items / activities covered in the contract / schedule of items required, right from material procurement to completion of the work at site

VOLUME-4
TECHNICAL DATA SHEETS (TDS)

1 GENERAL TECHNICAL REQUIREMENT

Guaranteed Technical Particulars

Item / Clause No.	Parameter	Owner Requirement
1	Whether all the dimensions conform to bid drawing dimensions	Yes
2	Any deviation recorded/ filed in the bid dimensions or any special/additional requirement	No

Bidder's Seal and Signature
/ Authorized Representative

2 SPV MODULE

Guaranteed Technical Particulars

Item / Clause No.	Parameter	Units	Owner Requirement
1	**PV Module**		
1.1	Type		Crystalline
1.2	Rated Power at STC in Wp		≥ 540
1.3	Module Efficiency at STC		≥ 20.79 %
1.4	Fill Factor		≥0.70
1.5	System Voltage		1000V DC (Min)
1.6	Temperature Coefficient Rated Power		>(-) 0.40%/°C
1.7	Number of Bypass Diodes		Min. 03 (three) per module
1.8	Embedding		EVA
1.9	Positive Power Tolerance		0 W to 5 W
1.10	Cables & Connectors		As per PTS
1.11	Junction Box (Halogen free, UV Stabilized)		≥IP 67
1.12	Ambient Temperature Range		(-) 10 ^{0}C to 60 ^{0}C
1.13	Maximum Static Load Capacity (Front)		As per IEC/ other applicable Standard
1.14	Maximum Static Load Capacity (Back)		
1.15	Wind Gust Withstand Capacity		≥170Kmph
1.16	Product Warranty (years)		≥ 5
1.17	Performance Warranty (years)		≥25
1.18	RFID Kit		to be included
1.19	Modules Compatible with Offered Inverter Model		Yes
1.20	Compliance of Standards and Technical Specification as per Chapter “2” of PTS		Yes

Bidder’s Seal and Signature / Authorized Representative

MONTHWISE RADIATION & GENERATION

The Bidder shall quote the Annual Minimum Guaranteed Generation (MGG) for the first year in the Price Schedule; however, the same should not be less than 474 Million kWh. The guaranteed energy generation shall be measured at Metering Point. The quoted energy shall not be more than 498 Million kWh.

Bidder shall quote the Annual MGG after taking into consideration the accuracy, uncertainty, variability of all measuring instruments such as Pyranometer, Energy Meter, CT, VT etc. The energy, solar radiation etc. recorded by instruments shall be treated as final and no adjustment/ correction shall be allowed on account of above said tolerances during O&M period including PG Test.

The bidder shall quote month-wise target energy generation for annual quoted energy generation (first year) and DC (At STC) /AC Capacity ratio (kW_P / kW_{AC}) selected by the bidder for the project in the following format. The Capacity ratio shall not be less than **1.36 (272 MWp/ 200MW).**

Bidders are also advised to visit site & land topography to appraise themselves with local conditions before quoting the generation & DC/ AC Capacity Ratio.

A. Monthwise Target Generation			
Sr. No.	Month	Average Global Horizontal Solar Insolation (GHI) for the Month (kWh/m^2)	Month wise Target Energy Generation for Annual Quoted Generation (kWh)
1	January	126.3	
2	February	137.3	
3	March	177.5	
4	April	194.2	
5	May	205.5	
6	June	177.3	
7	July	138.0	
8	August	135.1	
9	September	153.9	
10	October	153.1	
11	November	129.2	
12	December	120.9	
	Total	**1848.3**	
B. DC/AC Capacity ratio (kW_P / kW_{AC}) selected for the project			
1	DC/AC Capacity ratio (kW_P / kW_{AC})		

The bidder shall also furnish PV System Design Report (PV Syst) with simulation parameters / variants, shading diagrams, Production charts, loss diagrams, etc correlating with the above month wise Energy Generation data & DC/ AC Capacity Ratio. The DC/AC ratio (DC capacity considered) in this PV Syst report will be binding on the bidder during execution of the project i.e; this DC capacity will be treated as the minimum capacity of DC to be installed in the project.

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/ Authorized Representative

3 MODULE MOUNTING STRUCTURES
Guaranteed Technical Particulars

Item / Clause No.	Parameter	Units	Owner Requirement
1	**Mounting Structures**		
1.1	Structure Type		Single Axis East West Tracker
1.2	Type of coating to be used & Thickness (If applicable)		As per Chapter 3 of PTS
1.3	Hardware/ Fasteners		As per Chapter 3 of PTS
1.4	Design Wind Speed		Not less than 170 Km/hr
2	Compliance of Standards and Technical Specification as per Chapter "3" of PTS		Yes

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4. POWER CONDITIONING UNITS
Guaranteed Technical Particulars

Item / Clause No.	Parameter	Units	Owner Requirement
1	**Power Conditioning Units**		
1.1	Cumulative MW capacity of PCU/ String Inverter		As per Chapter 4 of PTS- E&M
2	**INPUT**		
2.1	Allowable DC voltage		1000 V DC(Min)
3	**OUTPUT**		
3.1	Power Factor Control Range		As per Chapter 4 of PTS- E&M
3.2	Ambient Temperature		0°C to (+) 60◦C
3.3	Nominal Output Frequency		50 Hz
3.4	Equipped with VRT feature		Yes
3.5	THD		< 4% at Nominal Load / as per CEA norms whichever is more stringent
3.6	Voltage Ripple PV Voltage		< 3%
3.7	Reactive Power Capability at Night		Yes
3.8	Over load Capacity (DC side)		Yes
4	**INPUT PROTECTIONS**		
4.1	Reverse Polarity Protection		Yes, included
4.2	DC Overvoltage Protection		Yes, included
4.3	DC Disconnector		Yes, included
4.4	Surge Protection		Yes, included
5	**OUTPUT PROTECTIONS**		
5.1	AC Overvoltage Protection		Yes, included
5.2	AC Circuit Breaker		Yes, included
5.3	Islanding Protection		Yes, included
5.4	Lighting Protection		Yes, included
5.5	Ground Fault Detection &		Yes, included

Technical Data Sheets (TDS)

	Interruption		
Item / Clause No.	**Parameter**	**Units**	**Owner Requirement**
6	**POWER CONSUMPTION**		
6.1	Max self consumption in operation (Watts)		<1% of rated power
6.2	Max Night/Standby consumption in operation (Watts)		<0.05% of rated power
7	**Efficiency (Excluding auxiliary)**		
7.1	Maximum Efficiency		>98.0%
8	**ENVIRONMENTAL PARAMETERS**		
8.1	Maximum Relative Humidity (Non Condensing)		95%
9	Compliance of Standards and Technical Specification as per Chapter "4" of PTS		Yes

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/ Authorized Representative

5 CABLING SYSTEM

Guaranteed Technical Particulars

Item / Clause No.	Parameter	Unit	Owner Requirement
1	**MV Power Cables**		
1.1	Type	-	XLPE , FR-LSH
1.2	Nominal Voltage	kV	33
1.3	Insulation Type		XLPE
1.4	Conductor		Aluminium Stranded
1.5	Screen		Copper Extruded
1.6	Aluminium Armour Provided		Yes
1.7	Short Circuit Current Rating for 1 Sec	kA	As per IEC/ IS Standard
2	**Low Voltage Power Cables**		
2.1	Type	-	XLPE, FR-LSH
2.2	Rated Voltage	kV	1.1
2.3	Insulation Type		XLPE
2.4	Conductor		Aluminium/Copper Stranded
3	**Control and Instrumentation Cables**		
3.1	Type	-	PVC,FR-LSH
3.2	Voltage Rating	V	Min 650
3.3	Conductor		Copper Annealed Stranded
4	**DC Cables**		
4.1	Conductor & Insulation		As per Chapter 5 of PTS
4.2	Nominal Voltage		1.5 kV (DC) for 1000 V System/ 3.3 kV (E) for 1500 V System
5	**Cable Trays**		
5.1	Type	-	Perforated & Ladder
5.2	Material	-	MS fully Galvanized
5.3	Minimum Thickness of Cable Trays	Mm	2
6	Compliance of Standards and Technical Specification as per Chapter "5" of PTS	-	Yes

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/ Authorized Representative

Technical Data Sheets (TDS)

6 METEROLOGICAL INSTRUMENTS
Guaranteed Technical Particulars

Item / Clause No.	Parameter	Unit	Owner Requirement
1	**Pyranometer**		As per Chapter "6"of PTS
1.1	Spectral Response		
1.2	Sensitivity		
1.3	Time Response		
1.4	Temperature Range		
1.5	Accuracy		
2	**Thermometer**		
2.1	Temperature Range		
2.2	Accuracy		
3	**Wind Speed Sensor &Wind Direction Sensor**		
3.1	Velocity Range		
3.2	Accuracy		

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/ Authorized Representative

7 STRING COMBINER BOX
Guaranteed Technical Particulars

Item / Clause No.	Parameter	Units	Owner Requirement
1	**String Combiner Box**		
1.1	System Voltage		1000V DC (Min)
1.2	Operating Ambient Temperature		0°C to + 55°C
1.3	Minimum protection class against water projections/ environments and to avoid ingress of fauna		As per Chapter "6"of PTS
1.4	Protection against impacts as per IEC/EN 62262 or equivalent standard		IK-08 or better
2	Enclosure shall be made of insulated material, PC or polyester with internally embedded gaskets, UV resistant, free of halogen, and self-extinguishing to avoid fire propagation		Yes
3	Compliance of Standards and Technical Specification as per Chapter "7" of PTS		Yes

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/ Authorized Representative

8 POWER TRANSFORMER

Guaranteed Technical Particulars

Item / Clause No.	Parameter	Unit	Owner Requirement
	Power Transformer		
1	Rated Continuous MVA at max. Ambient Temperature	MVA	As per Chapter "8"of PTS
2	**Nominal Voltages**		
2.1	- HV winding	kV	220
2.2	- LV winding	kV	33
3	**Highest Voltage of Equipment Um**		
3.1	- HV winding	kV	As per IS/IEC/CEA
3.2	- LV winding	kV	36
4	**Maximum Temperature Rise at Rated Power**		
4.1	- Top oil (measured by thermometer)	^{0} C	50
4.2	- Windings (measured by resistance)	^{0} C	55
5	Type of Cooling	-	ONAN
6	**Short Duration Separate Source Power Frequency Withstand Voltage**		
6.1	- HV Winding / Bushing	kV (r.m.s)	As per CEA Standard Technical Specification of Transformer for Solar Park Pooling Substation
6.2	- LV Winding / Bushing	kV (r.m.s)	
6.3	- LV & HV Neutral Bushing	kV (r.m.s)	
7	**Lightning Impulse Withstand Voltage**		
7.1	- HV Winding / Bushing	kV (Peak)	As per CEA Standard Technical Specification of Transformer for Solar Park Pooling Substation
7.3	- LV Winding / Bushing	kV (Peak)	
7.2	- LV & HV Neutral Bushing	kV (Peak)	

Technical Data Sheets (TDS)

DELETED

Item / Clause No.	Parameter	Units	Owner Requirement
8	Vector Group		As per system Requirement
9	% Impedance Voltage at Rated Power referred to 75°C winding temperature	-	As per IS 2026 (No Negative tolerance)/ As per CEA Standard
10	Short Circuit Withstand Capacity	-	As per Table-2 of IEC 60076-5/ As per CEA Standard
11	Max. Flux Density at Rated Voltage and Frequency	Tesla	1.65
12	Type of Insulation		
12.1	- HV winding	-	Minimum Class A
12.2	- LV winding	-	Minimum Class A
13	Material of the Winding Conductor	-	Copper
14	Oil Quality	-	As per IEC 60296-2003/ IS 335-1994/ As per CEA Standard Technical Specification of Transformer for Solar Park Pooling Substation
15	Temperature measuring range	-	0^0C to 150^0C
16	Type of Conservator	-	As per CEA Standard Technical Specification of Transformer for Solar Park Pooling Substation
17	**Type of Bushing**		
17.1	- HV Terminal	-	As per CEA Standard Technical Specification of Transformer for Solar Park Pooling Substation
17.2	- LV Terminal	-	
18	- Neutral Terminal	-	
19	Core material	-	High Grade CRGO
20	Compliance of standards and Technical Specification as per chapter “8” of PTS.	-	Yes

Bidder’s Seal and Signature
/ Authorized Representative

9 SOLAR POWER TRANSFORMERS (INVERTER DUTY TRANSFORMER) AND STATION SUPPLY TRANSFORMER/ AUXILLIARY TRANSFORMER

Guaranteed Technical Particulars

Item / Clause No.	Parameter	Units	Owner Requirement
1	**Solar Power Transformer (SPT)/ Inverter Duty Transformer (IDT)**		
1.1	VA Rating		As per at Chapter 9 of PTS requirement
	Voltage Ratio	kV	33/ LV (As per manufacturer configuration)
	Winding		2(Two) to 5(Five)
	Frequency	Hz	50
1.2	Tap Changer	Nos.	OCTC (off load),+/- 5%@2.5% step on HV
1.3	Maximum Temperature Rise in winding at Rated Power, Frequency and on tap producing highest losses (measured by resistance)	°C	55
1.4	Percentage Impedance Voltage at Rated Power, referred to 75°C and on principal tapping	%	As per at Chapter 9 of PTS requirement
1.5	Core & Winding		High Grade CRGO M4 or better & Copper/ Aluminium
1.6	Class of Insulation		A
1.7	Type of Cooling		As per at Chapter 9 of PTS requirement
2	**Station Service Transformer (SST) & Auxiliary Transformer**		
2.1	VA Rating		As per at Chapter 9 of PTS requirement
	Voltage Ratio	kV	33 kV (For SST) & Generated Voltage (For Aux. Tr) / 0.433 Kv
	Winding		Two
	Frequency		50

Technical Data Sheets (TDS)

Item / Clause No.	Parameter	Units	Owner Requirement
2.2	Tap Changer	Nos.	OCTC (off load),+/- 5%@2.5% step on HV
2.3	Maximum Temperature rise in winding at Rated Power, Frequency and on Tap producing Highest Losses (Measured by resistance)	Deg C	As per at Chapter 9 of PTS requirement
2.4	Percentage Impedance Voltage at Rated Power, referred to 75°C and on principal tapping	%	As per IS
2.5	Core & Winding		High Grade CRGO M4 or better & Copper/ Aluminium
2.6	Class of Insulation		A
2.7	Type of Cooling		As per at Chapter 9 of PTS requirement
3	Compliance of Standards and Technical Specification as per chapter “9” of PTS.		Yes

Bidder’s Seal and Signature
/ Authorized Representative

10 DC SYSTEMS

Guaranteed Technical Particulars

Item / Clause No.	Parameter	Unit	Owners Requirement
	220 V/ 110 V DC System		
1	**220 V/110 V Battery Charger**		
1.1	Type	-	Float & Boost
1.2	Power Supply	-	415V±10%, 3Φ, 4 wire
1.3	Maximum Ripple of Output Voltage (Peak to Peak)		
	With the battery connected	% U_N	<1%
	Without the battery connected	% U_N	<1%
1.4	Protection Class of Cubicle		IP- 42
2	**220V/ 110 DC Battery**		
2.1	Type	-	VRLA
2.2	Battery Capacity at 25°C	AH	As per system requirement
2.3	Rated Voltage U_N	V	220/110
2.4	Battery rack should be earth resistant	-	Yes
3	**220 V/110 V DC Main Distribution Board**		
3.1	Type	-	Free Standing
3.2	Protection Class of Cubicle	-	As per Chapter 10 of PTS
4	**Inverter**		
4.1	DC Supply		
	Input voltage	V	220 V DC/ 110 V DC
	Max Admissible variation of Input Voltage	%	10% / -20%
	Rated Voltage Un	V	415
	Rated Output	kVA	As per Chapter 10 of PTS (E&M)
4.2	Short Time Overload Capability (100 ms)	% I_N	2 times Rated Current
4.3	Maximum Distortion Factor of Voltage Waveform (THD)	%	5% at Linear load & 7% at 100% Non linear
5	Compliance of Standards and Technical Specifications as per Chapter "10" of PTS.	-	Yes

Bidder's Seal and Signature / Authorized Representative

11. CONTROL AND MONITORING SYSTEM

Guaranteed Technical Particulars

Item / Clause No.	Parameter	Unit	Owner Requirement
1	**General**		
1.1	Type	-	Distributed and independent control modules in hierarchical control levels.
2	**Performance Data**		
2.1	System Guaranteed Response Times		
2.1.1	Order Response Time	ms	≤ 20-500 millisecond
2.2	Overall Control and Monitoring System availability for top order event "Availability to retrieve all process data from_RTU/DCUs and operate all breakers"	%	≥ 99.98
2.3	Availability Data Channel for real time, Full Duplex Transmission at the rate of 100Mbps (Min) between two remote stations	%	≥ 99.99
2.4	Accuracy of Energy Meters		0.2S
2.5	No of years of archival of entire plant data base capacity	No of years	Min 25 years
2.6	System Operation in all stable states	-	Yes
2.7	The Control Room System shall have the following provisions	-	Yes
	- Scaleable (for future extensions)	-	Yes
	- Backward Compatibility & Interoperability with other sub-system including Multi-Vendor Platform	-	Yes
	- Ease of Maintenance	-	Yes
	- Service Availability & Adaptability for Future Technology Developments	-	Yes
2.8	The overall Control & Monitoring System shall comply with IEC 60870-5 series	-	Yes
2.9	The network equipments shall have a high level of security features in order to prevent any kind of external intrusion / hacking event into system	-	Yes

Technical Data Sheets (TDS)

Item / Clause No.	Parameter	Unit	Owner Requirement
3	**Characteristic Data**		
3.1	Type of interfaces / ports provided at RTU/DCUs for connection with Mobile Engineering Stations	-	Yes
3.2	**Optical Fiber**		
3.2.1	Optical Fiber Core/Cladding Diameter	µm/µm	As per IEC 60793
3.3	Type of Communication Ports	-	Serial Ethernet / Parallel
3.4	**Networks of Control System**		
3.4.1	Power Plant LAN		
3.4.1.1	-Type	-	Ethernet
3.4.1.2	- Data Transfer Rate	Mbps	100 (Minimum)
3.4.2	Control Room Network		
3.4.2.1	- Data Transfer Rate	Mbps	100 (Minimum)
3.5	GPS System Provided	-	Yes
3.6	Protection Class (IP) of Panel Enclosure	-	IP 52
4	Compliance of Standards and Technical Specifications as per Chapter “11” of PTS	-	Yes

Bidder’s Seal and Signature
/ Authorized Representative

12 PROTECTION SYSTEM

Guaranteed Technical Particulars

Item / Clause No.	Parameter	Unit	Owner Requirement
1	**General**		
1.1	Protection class of cubicle IP54	-	Yes
1.2	Type of Protection relays - Numerical	-	Yes
1.3	Conforming to IEC 60255	-	Yes
1.4	Test blocks in panels provided	-	Yes
1.5	Communication with plant control at IEC 60870-5-103	-	Yes
1.6	All protections covered as per scope/specification mentioned in PTS	-	Yes
2	**Numerical Relays**		
2.1	Event Logger Provided	-	Yes
2.2	DR Provided	-	Yes
2.3	RS 232 Ports provided	-	Yes
2.4	Time Sync feature provided	-	Yes
2.5	Numerical Relays with front panel display	-	Yes
2.6	The Supply, installation and Commissioning of necessary protection arrangement at solar power plant in conformity of GSECL/Central/ State Transmission Utility (CTU/ STU) and CEA	-	Yes
2.7	Compliance of Standards and Technical Specification as per Chapter “12” of PTS	-	Yes

Bidder’s Seal and Signature
/ Authorized Representative

13 33 KV SWITHGEAR
Guaranteed Technical Particulars

Item / Clause No.	Parameter	Unit	Owners Requirement
1	**General**		
1.1	Type	-	VCB Draw out/ SF6
1.2	Highest Voltage for Equipment Um	kV	36
1.3	Rated Short Duration Power Frequency Withstand Voltage (1 Minute)	kVrms	70
1.4	Rated Lightning Impulse Withstand Voltage	kV	170
2	**Switchgear Cubicles (P/H and Potyard)**		
2.1	Insulation Medium	-	Air
2.2	Rated Current of bus bar	A	As per IEC/IS
2.3	Conductor Material	-	Copper/ Aluminium
2.4	Material of Enclosures	-	Cold Rolled Sheet Steel
2.5	Rated Voltage	kV	As per IEC/IS
2.6	Rated Frequency	Hz	50
3	**Circuit Breakers**		
3.1	Arc Quenching Medium	-	Vacuum/SF6
3.2	Rated Short-Circuit Breaking Current	kA rms	25 kA for 1 sec (Min)
3.3	Rated Short-Circuit Making Current	kApeak	As per system requirement
3.4	Rated Operating Sequence	-	O-0.3sec-CO-3min-CO
3.5	Operating Mechanism		
	- for Closing	-	Motor Charged Spring Operated
	- for Opening	-	Spring Operated
4	Compliance of Standards and Technical Specification as per Chapter “13” of PTS	-	Yes

Bidder’s Seal and Signature
/ Authorized Representative

14 415 V SWITCHGEAR

Guaranteed Technical Particulars

Item / Clause No.	Parameter	Unit	Owner Requirement
1	**415V Switchgear**		Distribution Boards
1.1	System Voltage for Equipment Um	V	415
1.2	Power Frequency Withstand Voltage (1 Minute)		
	- Main circuits	V	As per IEC/IS
	- Control circuits	V	As per IEC/IS
2	**Distribution Boards**		
2.1	Material of Bus bar	-	Copper/ Aluminium
2.2	Protection Class	-	As per Chapter “14”of PTS
3	**Circuit Breaker**		
3.1	Rated Current (at 40°C) as per system requirement	A	Yes
4	**Moulded Case Circuit Breaker**		
4.1	Symmetrical Short Circuit Breaking Current	kArms	As per Chapter “14”of PTS
5	**Current Transformers (incoming Circuits)**		
5.1	Accuracy Class		
	Measuring cores	-	0.5
	Protection cores	-	5P20
6	Type / Designation of Meters	-	Digital
7	Compliance of Standards and Technical Specification as per Chapter “14” of PTS	-	Yes

Bidder’s Seal and Signature
/ Authorized Representative

15 ILLUMINATION SYSTEM

Guaranteed Technical Particulars

Item / Clause No.	Parameter	Unit	Owner Requirement
	Average Lux Levels		
1	**General Areas**		
1.1	Store and Switchgear	Lux	200
2	**Office Areas**		
2.1	Offices and Control Room	Lux	300
2.2	Conference Room	Lux	300
3	**Equipment Areas**		
3.1	Inverter Rooms (For indoor)	Lux	150
4	**Outdoor Areas**		
4.1	Switchyard Area	Lux	As per PTS
5	**Illumination**		
5.1	All Energy Efficient LED type Illumination system for indoor and outdoor area		Yes
6	**Circuit Breakers/ Fuse Load Break Switches**		
6.1	Type	-	MCB
6.2	Service Voltage	V	415V/ 240V
7	**Emergency Lighting**		
7.1	AC based	-	Yes
8	Emergency Lighting Lux Level	-	Minimum 20
9	Compliance of Standards and Technical Specification as per Chapter “15” of PTS.	-	Yes

Bidder’s Seal and Signature
/ Authorized Representative

16 GROUNDING SYSTEM

Guaranteed Technical Particulars

Item / Clause No.	Parameter	Units	Owner Requirement
1	**Grounding System**		
1.1	The equivalent resistance of the earth network shall be less than 1.0	Ohm	Yes
2	**DC side Lightning and Surge Protection (AJ/MJB/CB & Inverters):**		
2.1	Inbuilt lightning and Surge Protection as per Standards		As per Chapter 16 of PTS-E&M
2.2	The protection system should consist of Y connected MOVs and total SPD should be rated for total current at 8/20 microsecond surge		As per Chapter 16 of PTS-E&M
3	**Lightning and Surge Protection:**		
3.1	AC& DC Equipment of the plant should have (as per NFC17-102, IEC623056),20 kA(min) surge suppression inbuilt		Yes
4	Lightning Protection System		Yes
5	Compliance of Standards and Technical Specification as per Chapter “16” of PTS.		Yes

Bidder’s Seal and Signature
/ Authorized Representative

17 FIRE FIGHTING SYSTEM

Guaranteed Technical Particulars

Item / Clause No.	Parameter	Unit	Owners Requirement
	Fire Detection and Alarm system		
1	Type/Designation	-	Microprocessor Based Addressable Intelligent Type
2	Compatibility of Fire Protection System with station SCADA	-	Yes
3	Compliance of Standards and Technical Specification as per Chapter "17" of PTS.	-	Yes

Bidder's Seal and Signature
/ Authorized Representative

18 OUTDOOR SWITCHYARD
Guaranteed Technical Particulars

Item / Clause No.	Parameter	Unit	Owner Requirement
1	Nominal Voltage	kV	220
2	Maximum Voltage	kV	245
3	Rated Frequency	Hz	50
4	Power Frequency Withstand Voltage, (One) 1 Minute		
	- Phase to Ground	kVrms	460
	- Phase to Phase	kVrms	------
5	Lightning Impulse Withstand Voltage against ground (1Minute)	kVpeak	1050
6	Maximum Partial Discharge at Highest Voltage for Equipment	pC	10
7	Rated Short Time Withstand Current (rms) for (One) 1 sec.	KA	40
8	Rated Peak Withstand Current	KA	100
9	**Capacitance Voltage Transformers**		
9.1	Accuracy Class		
	- For Protection	-	3P (2-core)
	- For Metering	-	0.2
9.2	Voltage Ratio	-	(110/√3)kV/(110√3)V/ (110/√3)V/(110/√3) V
9.3	Rated Voltage Factor	-	1.5 for 30 Sec 1.2 for Continuous
10	**Surge Arrestors**		
10.1	Type	-	Gapless Metal Oxide Heavy Duty Station Type
10.2	Rated Arrestor Voltage	kVrms	216
10.3	Maximum Continuous Operating Voltage	kVrms	168
10.4	Nominal Discharge Current (8/20 µs wave shape)	kA	40
10.5	High-Current Short Duration Test value (4/10 µs)	kA	100

DELETED

Technical Data Sheets (TDS)

Item / Clause No.	Parameter	Units	Owner Requirement
10.6	Minimum Thermal Capability	kJ/kV	5
10.7	Discharge Class		Class III
10.8	Protection Class of Discharge Counter		IP 55
11	**Connectors**		
11.1	Applicable Standard	-	NEMA 107
11.2	Material	-	Aluminium Alloy
11.3	Maximum Noise Level	dB	54
11.4	Applicable Standard for Fasteners	-	IS 3506
11.5	Min. Mechanical strength of Fasteners	-	Class 70
11.6	Tensile Strength/Electrical characteristics of Hardware	-	NEMA CC1 Publications
12	The Supply, Installation and Commissioning of Switchyard Equipment and necessary protection arrangement at plant end and standards in conformity of State Transmission Utility (STU)/ Central Transmission Utility (CTU)/ Electricity Regulatory Commission/ CEA/ Grid Code/LDC		Yes
13	Compliance of Standards and Technical Specification as per Chapter “18” of PTS.	-	Yes

DELETED

Bidder’s Seal and Signature
/ Authorized Representative

19 POWER EVACUATION SYSTEM

Guaranteed Technical Particulars

Item / Clause No.	Parameter	Unit	Owner Requirement
	Conductor		
1	Chemical Composition of Conductor	%	As per IS standard
2	Aluminum Strands after Stranding		
2.1	Diameter	mm	As per IS standard
	Nominal, Maximum & Minimum	mm	As per IS standard
3	Minimum Breaking Load of Strand	KN	As per IS standard
4	Ultimate Tensile Strength	KN	As per IS standard
5	Max Resistance (1 m Length)	Ohm	As per IS standard
6	D.C Resistance of Conductor at 20°C	Ohm/KN	As per IS standard
7	Standard Length of Conductor	Meter	As per IS standard
8	Tolerance of Standard Length of Conductor		As per IS standard
	Insulator		
9	Type of Insulator Offered	-	As per IS standard
9.1	Overall Dimension		As per IS standard
	Height & Diameter	-	As per IS standard
10	Nominal System Voltage	KV	220
11	Highest System Voltage	KV	245
12	Minimum Failing Load	KN	As per IS standard
13	Dry PF Flash Over Voltage	KV	As per IS standard
14	Puncture Withstand Voltage	KV	As per IS standard
15	Minimum Creepage Distance	MM	As per IS standard
16	Impulse Flashover Voltage		
	1.2/50 micro sec wave of Positive & Negative Polarity	KVp	As per IS standard
17	Impulse Withstand Voltage		
	1.2/50 micro sec wave of Positive & Negative Polarity	KVp	As per IS standard
18	Dry & Wet Power Frequency Withstand Voltage (1 Minute)	KV	As per IS standard
20	Min Visible Discharge Test Voltage	KV	As per IS standard
21	Tolerance in Dimension, if any	-	As per IS standard

Bidder's Seal and Signature

Technical Data Sheets (TDS)

DEEP

of Authorized Representative

Technical Data Sheets (TDS)

VOLUME-5

FORMS & PROCEDURES (FP)

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5c	Deleted
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6	Form of Trust receipt for plnt, Equipment and Materials received
7a	Form of Indemnity Bond to be executed by Contractor for Equipment

	handed over in installments by the Employer for Performance of its Contract
7b	Form of Indemnity Bond to be executed by Contractor for custom clearance and reconciliation of Imports
7c.	Form of High Seas sale agreement
8.	Form of Authorization Letter
9.	Statement of Performance
10	Form of joint venture/consortium agreement
11 (I)	Deleted
11 (II)	Deleted
12 (a)	Proforma of certificate from the CEO/CFO of the holding company
12 (b)	Proforma of undertaking
12 (c)	Proforma of certificate from the CEO/CFO in accordance with item clause 3.2.B.3 of eligibility criteria
12 (d)	Joint letter of undertaking between the CEO of the holding company / group company or subsidiary company & CEO of the bidder company
13 (a)	Deleted
14	Undertaking from parent/ holding company
15	Parent/ holding company agreement
16	Parent/ Holding Company Agreement (In case of Joint Venture/Consortium)
17	Deleted

1. BID FORM

Date.....….....
NIT No. .....

Name of Contract..... .....

To: (Name and Address of Employer)

Gentlemen and / or Ladies,

1.0 Having read & examined the following Bidding Documents relating to '**_____(Name of Project)_____**, including Addenda Nos. *(Insert Numbers)*, the receipt of which is hereby acknowledged, we the undersigned, offer to design, manufacture, test, deliver, install and commission (including carrying out Performance & Guarantee Test) including remedying the defects therein of the Facilities under the above-named Contract in full conformity with the said Bidding Documents for the sum of:

.....(Amount of Local Currency in Words)..... (.....)
(Amount in Figures)

(Price to be left in Part-I submissionTechnical Bid and Qualification Particulars)

or such other sums as may be determined in accordance with the terms and conditions of the Contract.

2.0 **Attachments to the Bid Form:**

In line with the requirement of the Bidding Documents we enclose herewith the following Attachments to the Bid Form:

(a) Attachment 1: Bid Security Declaration valid for a period of 120 days from the last date set for online submissionof bids.

(b) Attachment 2: A Power of Attorney duly authenticated by a Notary Public indicating that the person(s) signing the bid have the authority to sign the bid and thus that the bid is binding upon us during the full period of its validity in accordance with the ITB Clause 13.

(c) Attachment 3: The documentary evidence establishing in accordance with ITB Clause 2 that we are eligible to bid and in terms of ITB Clause 10.2 (c) & (d) are qualified to perform the contract if our bid is accepted. The qualification data has been furnished as per your format enclosed with the bidding documents.

(d) Attachment 4: Our Appreciation of the Project and the documentary evidence establishing in accordance with ITB Clause 3 that the Facilities offered by us are eligible Facilities and conform to the Bidding Documents has been furnished as Attachment 4. Moreover, all the Bidding Documents as per ITB Clause 6.1, duly signed and stamped on each page as a proof of its acceptance except to the variation/deviations mentioned in Attachment-6 (without cost of withdrawal) and Attachment-6A (with cost of withdrawal) has also been furnished with this Attachment.

All the detailed technical information & data and Guaranteed Technical Particulars duly filled in as per the requirement of Technical Data Sheet (Volume 4) is also furnished.

A list of tools & tackles to be furnished for reference purpose as at Attachment 4A. However, such tools & tackles shall not be required to be supplied to Employer but shall be made available as and when required for erection / O&M activities of this project.

(e) Attachment 5: We agree to accept the names of approved vendors mentioned in Attachment-5 under heading 'A' – "List of Approved Vendors". Further, we understand that the

inclusion of additional vendors in the list of approved vendors shall be governed under GCC Clause no. 19.1 of Bid documents.

(f) Attachment 6: The variation and deviations from the requirements of the Conditions of Contract and other commercial conditions, Technical Specification in your format enclosed with the Bidding Documents without indicating cost of withdrawal.

(g) Attachment 6A: The variation and deviations from the requirements of the Conditions of Contract and other commercial conditions, Technical Specification in your format enclosed with the Bidding Documents, indicating, inter alia, the cost of withdrawal of the variation and deviations.

(h) Attachment 7: Brief Integrated PERT Network (L2 Schedule) in line with the Implementation schedule in SCC Cl. 9.0

(i) Attachment 8: Detailed Site Report. The bidder shall submit a report about the proposed site mentioning the brief detail of land.

The Bidder shall submit detailed write-up along with data as sought under various sections of the Bidding Documents

(j) Attachment 9: Deleted.

(k) Attachment 10 : Anti Profiteering Certificate

(l) Attachment 11: HSN / SAC Code for the BOQ Items

(m) Attachment 12: Declaration regarding Insolvency Proceedings under Insolvency and Bankruptcy Code 2016 Declaration regarding Insolvency Proceedings under Insolvency and Bankruptcy Code 2016.

(n) Attachment 13: Self-Certificate for Cyber Security

(o) ANNEXURE -8: Process Compliance form for e-RA

(p) ANNEXURE -9: Price Confirmation form for e-RA

#.....

 # (Any other Attachment, if required, shall be added here)

3.0 **PRICE SCHEDULES:**

3.1 In line with the requirements of the Bidding Documents, we enclose herewith the following Price Schedules, duly filled-in as per your Proforma:

Price Schedule No.1	Schedule of Price for "Supply of Plant & equipment including Specified spares, tools and instruments complete in all respect" for Solar PV Power Plant**.**
Price Schedule No.2	Schedule of price for **"**Providing Installation, Testing & Commissioning of Plant including Transmission Network including all services i.e storage, handling at Site, including all other Civil Works, Land Development including statutory approval, permits, license etc. complete in all respect" for Solar PV Power Plant."
Price Schedule No.3	Schedule of Price for "Comprehensive operation and maintenance including all statutory approval, permits, license, testing, caliberation etc. in respect of all the equipment supplied under the First Price

	Schedule and any other Services specified in the Contract Documents (Second Contract) for 05 years from commissioning of Plant and Annual Maintenance Contract (AMC) of the equipments (hereinafter referred as O&M Schedule)."
Price Schedule No.4	Grand Summary (Total Sum of Price Schedules 1 to 3 quoted by the bidder) obtained as per spreadsheet calculations.
Price Schedule No.5	"Total Generation in Units (*for First Year in kWh*)" as quoted by the Bidder.
Price Schedule No. 6	Bid Price per units of Generation (i.e. Sum of Price Schedule 1 to 3 i.e. Price Schedule-4 divided by Generation in Units quoted by the Bidder in Price Schedule – 5. This value is obtained as per spreadsheet calculations.

3.1.1 We confirm that we have quoted our prices as described in the various sections of Bidding Documents for the **" Setting up of 200 MW Solar Power Project in 600 MW in Solar park (Stage-1) of Gujarat State Electricity Corporation Ltd.(GSECL) at Khavda, Gujarat"** complete in all respect and its comprehensive O&M for **05** years including Defects Liability Period from the date of stabilization of entire Power Plant in the respective Price Schedules.

3.1.2 We further confirm that Price Schedule 1 to 6 has been submitted in Electronic form on the portal and any other pricing information like deviation etc. have been prepared by us and furnished in separate form along with "Price Bid".

3.1.3 We accept that the 'Price Schedule 6: Bid Price per units of Generation obtained as per spreadsheet calculations i.e. Price Schedule – 4: Grand Summary (i.e. Sum of Price Schedule 1 to 3) obtained as per spreadsheet calculations divided by Generation in Units quoted by the Bidder under PriceSchedule–5: "Total Generation in Units" submitted in Electronic form on the portal by us.

We confirm that the prices under various schedules have been quoted by us taking into account the input tax credit and other benefits.

3.2 We are aware that the Price Schedules do not generally give a full description of the work to be performed under each item and we shall be deemed to have read the Employer's Requirements (Technical Specifications) and other Bidding Documents to ascertain the full scope of work included in each item while filling-in the rates and prices. We agree that the entered rates and prices shall be deemed to include for the full scope as aforesaid, including overheads and profit.

3.3 We declare that as specified in the Conditions of Contract, prices quoted by us for the "Contract" shall be firmed till completion of Contract.

3.4 We understand that the total price as per schedule-4 and quoted generation as per scheulde- 5 shall be considered for evaluation of Bid to arrive at the lowest competitive bid and to arrive at the Contract Price.

3.5 We declare that Price column of sub-items left blank in an item in the Schedules will be deemed to have been included in other sub-items of that item. The TOTAL for each Schedule and the GRAND TOTAL shall be deemed to be the total price for executing the Facilities and sections thereof in complete accordance with the Contract, whether or not each individual sub-item has been priced.

3.6 We hereby also declare that we are not declared ineligible under para 6 of Guidelines of Business Dealings.

3.7 We confirm that except as otherwise specifically provided, our Bid Prices include all taxes, duties, levies and charges as may be assessed on us, our Sub-Contractor/Sub-Vendor or their employees by all municipal, state or national government authorities in connection with the Facilities.

3.8 Deleted

3.9 We confirm that all taxes, duties, levies and charges etc. have been quoted by us under Price Schedules 1,2 & 3 and no additional cost on account of any taxes/duties/levies/charges etc. shall be payable by you subject to GCC clause no. 14 & 36.

4. We confirm that we shall also get registered with the concerned Tax Authorities, in the state where the project is located.

5. Deleted.

6. Construction of the Contract

We declare that we have studied GCC/SCC relating to mode of contracting and we are making this proposal accordingly.

7. We have read the provisions of following clauses and confirm that the specified stipulations of these clauses are acceptable to us:

(a)	GCC 5	Governing Law
(b)	GCC 6	Settlement of Disputes
(c)	GCC 12	Terms of Payment
(d)	GCC 13.3	Performance Security
(e)	GCC 14	Taxes & Duties
(f)	GCC 26.2	Completion Time Guarantee
(g)	GCC 27	Defects Liability
(h)	GCC 28	Functional Guarantees
(i)	GCC 29	Patent Indemnity
(j)	GCC 30	Limitation of Liability
(k)	Appendix 2 to Form of Contract Agreement	Price Adjustment

8. We further declare that additional conditions, variations, deviations, if any, found in the proposal other than those listed in Attachment 6 and/or Attachment 6A, save those pertaining to any rebates offered, shall not be given effect to.

9. We undertake, if our bid is accepted, to commence the work on Facilities immediately upon your Notification of Award to us, and to achieve Completion within the time stated in the Bidding Documents.

10. If our bid is accepted, we undertake to provide an Advance Payment Security and a Performance Security in the form and amounts, and within the times specified in the Bidding Documents.

11. We agree to abide by this bid for a period of 120 days from the date fixed for submission of bids as stipulated in the Bidding Documents, and it shall remain binding upon us and may be accepted by you at any time before the expiration of that period. .

12. Deleted.

13. Until a formal Contract is prepared and executed between us, this bid, together with your written acceptance thereof in the form of your Notification of Award shall constitute a binding contract between us.

14. We understand that you are not bound to accept the lowest or any bid you may receive.

15. We confirm that we have filled-in the data required to be furnished by us in the Qualification Forms Total Energy estimation, Technical Data Sheet, Price Schedules, etc.

16. We, hereby, declare that only the persons or firms interested in this proposal as principals are named here and that no other persons or firms other than those mentioned herein have any interest in this proposal or in the Contract to be entered into, if the award is made on us, that this proposal is made without any connection with any other person, firm or party likewise submitting a proposal is in all respects for and in good faith, without collusion or fraud.

17. We confirm that we shall abide by the Quality Assurance and Testing Specifications provided in the Employer's Requirements (Technical Specification)

18. We confirm that our Bid including rates / prices quoted by us in the Schedules & Attachments are unconditional except to the extent mentioned in Attachment-6.

Dated this.....day of.....20.....

Thanking you, we remain,

Yours faithfully,

(Signature)
(Printed Name)
(Designation)
(Common Seal)

Date :
Place :

Business Address:
Country of Incorporation:
(State or Province to be indicated)

Name & Address of the Principal Officer:

Note: Bidders may note that no prescribed Proforma has been enclosed for:

(a) Attachment 2 - (Power of Attorney)
(b) Attachment 3 - (For documentary evidence establishing that we are eligible to bid & are qualified to perform the Contract if our bid is accepted.)
(c) Attachment 4 - (For documentary evidence establishing that the facilities offered are eligible facility and conform to bidding documents)

However, the Proforma for Special tools & tackles have been enclosed as Attachment – 4A.

For this Attachments 2, 3, 4 & 8, Bidders may use their own Proforma for furnishing the required information with the Bid.

****

ATTACHMENT – 1
Bid Security Forms
Bank Guarantee
(Refer ITB Clause 14)

(To be executed on Non-Judicial stamp paper of appropriate value)

Bank Guarantee No. Date: _____

(Name of Contract)

To: (Name and address of Employer)

WHEREAS (name of Bidder) (hereinafter called "the Bidder") has submitted its bid dated (date of bid) for the performance of the above-named Contract (hereinafter called "the Bid")

KNOW ALL PERSONS by these present that WE (name of Bank) of (address of bank) (hereinafter called "the Bank"), are bound unto NHPC Limited (A Government of India Enterprises) for the sum of: (amount), for which payment well and truly to be made to the said Employer, the Bank binds itself, its successors and assigns by these presents.

THE CONDITIONS of this obligation are as follows:

1. If the Bidder (a) withdraws or modifies its Bid during the period of bid validity or (b) adopts corrupt or collusive or coercive or fraudulent practices or defaults under the Integrity pact.
2. If the Bidder, having been notified of the acceptance of its Bid by the Employer during the period of bid validity
   a) fails or refuses to sign the Contract Agreement when required, or
   b) fails or refuses to submit the performance security in accordance with the Tender documents .
   c) If the Bidder fails to withdraw the deviations at the cost of withdrawl stated by him in the bid.

WE undertake to pay to the Employer up to the above amount upon receipt of its first written demand, without the Employer having to substantiate its demand, provided that in its demand the Employer will mention that the amount claimed by it is due, owing to the occurrence of one or both of the two above-named CONDITIONS, and specifying the occurred condition or conditions.

The Bank declares that this Bank Guarantee is issued by the bank, utilizing the credit limit of M/s----------(Name of Contractor)

This guarantee will remain in force up to and including (date 90 days after the period of bid validity), and any demand in respect thereof must reach the Bank not later than the above date.

For and on behalf of the Bank_____
in the capacity of Common Seal of the Bank_____

Common Seal of the Bank with complete address including Tel/Fax Nos

Staff Authority No. of the officer of the Bank /Signatory

INSTRUCTIONS FOR EXECUTION OF BANK GUARANTEE FOR EARNEST MONEY DEPOSIT

1. Bank Guarantee for Earnest Money Deposit should be executed on non-judicial Stamp papers of requisite value in accordance with the stamp Act if applicable to that particular state of Indian Union country of executing Bank, where executed. In case the same is issued by a first class International bank, the law prevalent in the country of execution shall prevail for the purpose of Stamp Duty on the Bank Guarantee. However, in such a case, the Bank Guarantee for Earnest Money Deposit shall be got confirmed by the Bidder through any Indian Scheduled/Nationalized Bank.

2. The executing officers of the Bank Guarantee for Earnest Money/Bid Security shall clearly indicate in (block letters) his name, designation, Power of Attorney No. / Signing Power No. as well as telephone/ fax numbers with full correspondence address of the issuing Guarantee etc.

3. Each page of the Bank guarantee for Earnest Money Deposit shall be duly signed/initialed by the executing officers and the last page shall be signed in full, indicating the particulars as aforesaid (sub-para 2) under the seal of the Bank.

4. Stamp paper shall be purchased in the name of Bank issuing the Bank Guarantee, after the date 'Notice Inviting Tender', not more than six (6) months prior to execution/ issuance of the Bank Guarantee. The name of the purchaser should appear at the back side of stamp paper in the Vendors Stamp. The issuing Bank shall be requested independently for verification/confirmation of the Bank Guarantee issued, non-confirmation of which may lead to rejection of 'Bid Security'.

5. Irrevocable, valid and fully enforceable Bank Guarantee in favor of the employer (Name of Employer) issued by any scheduled bank approved by the Reserve bank of India which is acceptable to the Employer. The Bank Guarantee issued by a Foreign Bank shall be routed through the corresponding branch of such scheduled foreign banks in India or any scheduled Bank, acceptable to the employer.

6. Bank Guarantee for Bid security in original shall be submitted along with the Bid. However, the issuing Bank shall submit an unstamped duplicate copy of Bank Guarantee to the Employer (authority inviting tenders) with a forwarding letter.

****

ATTACHMENT – 4A

(Name of the Project)

List of Special Maintenance Tools & Tackles

(Bidder's Name & Address):

To : ….....
(Name of the Employer)

Dear Sir,

We are furnishing below the list of tools & tackles required for Erection/O&M activities of this Project for reference purposes. These tools & tackles shall not be required to be supplied to Employer but shall be made available as & when required for Erection/O&M activities of this project.

S.No.	For Equipment	Item Description	Unit	Qty.

Notwithstanding what is stated above we further confirm that any additional special maintenance tools and tackles, required for the equipment under this package shall be deployed by us at no extra cost to the Employer.

Date : …..... (Signature)….....

Place : …..... (Printed Name)….....

(Designation)….....

(CommonSeal)….....

ATTACHMENT 5A

Indicative Vendor's List - Solar Power Project		
S.No.	**Item**	**Vendor's/ Subcontractor's Name**
1	SPV Module	SPV Modules from all vendors as per Latest Approved List of Models and Manufacturer (ALMM) of MNRE and those fulfilling the technical requirement mentioned in bid document are eligible for supply of SPV Modules. MNRE has issued an OM dated 22.05.2023 in respect of project to be commissioned till 10.03.2024 which is attached as Annexure-A. In case, ALMM abeyance order is further extended as per MNRE OM/orders to cover the project commissioning timeline in this tender and thus ALMM is not applicable for the project, the bidder/sub-vendor shall meet the requirement of Technical specifications and as stipulated below for supply of Solar PV Modules: 1. The bidder/ Subcontractor should have manufactured and supplied the Solar PV Modules of cumulative installed capacity of 40 MWp or above using any rating of modules and any source of indigenous or imported PV cells in any one financial year. 2. The bidder/ Subcontractor should have manufactured and supplied Crystalline Solar PV Module, built up using indigenous and/or imported PV Cells, of power rating 320 Wp or above, which should have completed at least six months of successful operation during the last Five (05) years ending last day of the month previous to the one in which NIT is published. The works referred to clause 1 & 2 can be in same or different projects. In case the solar PV module manufacturer is not meeting the requirement as mentioned in Clause 1 and/or 2 above, they can be accepted if its principal/holding or subsidiary company is meeting these criteria. 3. Shall have type tested product as per relevant latest IEC/ IS Certifications.

		4. Documentary evidence duly certified by contractor along with the complete details of the company profile be furnished.
2	Power Conditioning Unit/ String Inverter	1. BHEL 2. SMA 3. ABB 4. AEG 5. SCHEINDER 6. GE 7. HITACHI-HIREL 8. SUNGROW 9. DELTA 10. HUAWEI 11. FIMER 12. SINENG 13. TBEA
3	String Combiner Box	1. WEIDMULLER 2. SOCOMEC 3. HENSEL 4. CAPA ELECTRIC 5. TRINITY TOUCH 6. SMA 7. L & T 8. ABB
4	Power Transformer (Oil Filled Type)	1. BHEL 2. ALSTOM 3. SCHNEIDER 4. ABB 5. CGL 6. EMCO 7. KANOHAR 8. VOLTAMP 9. TOSHIBA
5	Inverter Duty Transformer (IDT) or Solar Power Transformer (SPT)	1. BHEL 2. ALSTOM 3. SCHNEIDER 4. ABB 5. CGL 6. EMCO 7. KANOHAR 8. VOLTAMP 9. ELECTROTHERM 10. TOSHIBA 11. DANISH

6	Circuit Breaker SF6/ VCB (Outdoor Type)	1. SIEMENS 2. ABB 3. CGL 4. BHEL 5. ALSTOM 6. L & T 7. SCHNEIDER
7	Isolator (Outdoor Type)	1. ALSTOM 2. HIVELAM 3. SCHIENDER 4. L & T 5. ELPRO 6. GE POWER 7. CGL 8. SIEMENS 9. BHEL
8	CVT	1. ALSTOM 2. ABB 3. CGL 4. BHEL
9	CT (Oil Filled Type)	1. ALSTOM 2. ABB 3. CGL 4. BHEL 5. KAPPA 6. PRAGATI 7. PRAYOG
10	MV Switchgear	1. BHEL 2. ABB 3. L & T 4. SIEMENS 5. CROMPTON GREAVES 6. SCHIENDER TECHNOCRAFT
11	LT Switchgear Panel/ Control Panel/ DCDB/ Annunciation Panel	1. C & S ELECTRIC 2. L & T 3. ABB 4. SIEMENS 5. GE 6. ALSTOM 7. SCHIENDER 8. BHEL 9. TECHNOCRAFT

12	SCADA	1. SIEMENS 2. SCHEINDER 3. GE 4. ABB 5. BHEL 6. ALSTOM 7. ADAPTIVE
13	C & R Panel	1. ALSTOM 2. SIEMENS 3. ABB 4. SCHNEIDER 5. BHEL 6. L & T 7. GE
14	HT/MV Cable	1. UNIVERSAL CABLE 2. TORRENT CABLE 3. POLYCAB 4. KEI 5. HAVELLS 6. KEC
15	DC Cable	1. SIECHEM 2. LAPP 3. STRUDER 4. LEONI 5. RADOX 6. PRYSMIAN 7. POLYCAB
16	LT AC Power Cable & Control Cables	1. POLYCAB 2. KEI 3. HAVELLS 4. UNIVERSAL CABLES 5. TORRENT CABLES 6. UCL 7. CCI
17	Instrumentation Cable	1. UNIVERSAL 2. CORDS CABLE 3. KEI 4. POLYCAB
18	Battery	1. EXIDE 2. HBL NIFE 3. AMARARAJA 4. AMCO 5. TATA
19	Battery Charger	1. M/S AMARARAJA 2. M/S HBL NIFE 3. M/S CHHABI ELECTRICAL 4. M/S CHLORIDE POWER 5. M/S STATCON 6. M/S DUBAS ENGG

20	Fire Alarm Panel (Microprocessor Based)	1. AUTRONICA 2. EDWARD 3. NOTIFIER 4. SCHRACK 5. HONEYWELL
21	Luminaries	1. CROMPTON 2. BAJAJ ELECTRICALS 3. PHILIPS 4. WIPRO 5. GE
22	Optical Fibre Cable (OFC)/ OPGW	1. BIRLA ERICSSON OPTICAL 2. AKSH FIBER 3. FINOLEX 4. R&M SWITZERLAND 5. HFCL 6. APAR
23	Complete Tracker System	1. GAMECHANGE SOLAR SERVICES INDIA PRIVATE LIMITED 2. M/S NEXTRACKER INDIA PVT LTD

No. 283/16/2023-GRID SOLAR

भारत सरकार / Government of India

नवीन और नवीकरणीय ऊर्जा मंत्रालय/ Ministry of New & Renewable Energy (MNRE)

ग्रिड सौर ऊर्जा प्रभाग / Grid Solar Power Division

Atal Akshay Urja Bhawan,
Lodhi Road, New Delhi – 110003
Dated: 10th March, 2023

OFFICE MEMORANDUM

Sub: Approved Models and Manufacturers of Solar Photovoltaic Modules (Requirements for Compulsory Registration) Order, 2019: Amendment - reg.

Ref:

i. MNRE's O.M. No. 283/54/2018-GRID SOLAR dated 2nd January, 2019 reg. Approved Models and Manufacturers of Solar Photovoltaic Modules (Requirements for Compulsory Registration) Order, 2019; and
ii. Amendment to Order at (i) above vide MNRE's O.M. No. 283/54/2018-GRID SOLAR-Part(1) dated 2nd February, 2021.
iii. Amendment to Order at (i) above vide MNRE's O.M. No. 283/54/2018-GRID SOLAR-Part(2) dated 13th January, 2022.
iv. Amendment to Order at (i) above vide MNRE's O.M. No. 283/54/2018-GRID SOLAR-Part(2) dated 28th March, 2022.
v. Clarification to Order at (i) above vide MNRE's O.M. No. 283/54/2018-GRID SOLAR-Part(5) dated 07th October, 2022.

With reference to the Approved Models and Manufacturers of Solar Photovoltaic Modules (Requirements for Compulsory Registration) Order, 2019 and subsequent amendments and clarification thereto, the undersigned is directed to convey that subject Order is hereby held in abeyance for one financial year, i.e. FY 2023-24. Thus Projects commissioned by 31.03.2024 will be exempted from the requirement of procuring Solar PV modules from ALMM.

2. This issues in line with the approval of Hon'ble Minister (NRE & Power).

(Sanjay G. Karndhar)
Scientist-D
Email: karndhar.sg@nic.in

To:

All concerned

Copy to:

Director (Technical), NIC, MNRE, for uploading on MNRE Website

ATTACHMENT – 5B:

DELETED

Attachment - 5 C		
C. Specific Qualification Criteria of sub-contractors / vendors proposed by Bidder		
Sr.No.	**Item**	**Qualification Criteria**
1	Deleted	Deleted
2	Power Conditioning Unit/ String Inverter	The Sub-contractor/vendor: i) Should have supplied similar type of material earlier during the last Five (05) years ending last day of the month previous to the one in which NIT is published. ii) The equipment so supplied should have been successfully commissioned for more than 50 MW capacities (Cumulative) solar PV Projects till last day of the month previous to the one in which NIT is published. iii) Should be an ISO certified company. iv) Should have manufacturing/servicing center in India and shall have type tested product as per relevant latest IEC/ IS Certifications. Documentary evidence duly certified by contractor along with the complete details of the company profile be furnished.
3	String Combiner Box	The Sub-contractor/vendor: i) Should have supplied equipment earlier during the last Five (05) years ending last day of the month previous to the one in which NIT is published ii) The equipment so supplied should have been in successful operation at three Solar PV plant. iii) Should be an ISO certified company. Documentary evidence duly certified by contractor along with the complete details of the company profile be furnished.
4	Power Transformer (Oil filled type)	The Sub-contractor/vendor: i) Should have successful experience in designing, manufacturing, supply, installation, testing & commissioning Capacity of 50 MVA or higher of 110kV class or above three-phase Power Transformers in last 10 years, ending last day of the month previous to the one in which NIT is published. ii) The items/equipment should have been in successful operation at least at three power station/ installations/Substation. iii) Should be an ISO certified company.

		Documentary evidence duly certified by contractor along with the complete details of the company profile be furnished.
5	Inverter Duty Transformer/ Solar Power Transformer	The Sub-contractor/vendor: i) Should have supplied similar equipment earlier during the last Five (05) years ending last day of the month previous to the one in which NIT is published ii) The equipment so supplied should have been in successful operation at three Solar PV plant. iii) Should be an ISO certified company. Documentary evidence duly certified by contractor along with the complete details of the company profile be furnished.
6	Circuit Breaker SF6/VCB (Outdoor Type)	The Sub-contractor/vendor: i) Should have manufactured, supplied and commissioned relevant items/equipment earlier during the last ten (10) years ending last day of the month previous to the one in which NIT is published. ii) The items/equipment should have been in successful operation at least at three power station/ installations/Substation. iii) Should be an ISO certified company. Documentary evidence duly certified by contractor along with the complete details of the company profile be furnished.
7	Isolator (Outdoor Type)	
8	CVT	
9	CT (Oil Filled Type)	
10	MV Switchgear	The Sub-contractor/vendor: i) Should have manufactured and supplied similar equipment at power stations/substation/any government organization. ii) The items/equipment should have been in successful operation at least at three power station/ installations. iii) Should be an ISO certified company. Documentary evidence duly certified by contractor along with the complete details of the company profile be furnished.
11	LT Switchgear Panel/Control Panel/DCDB/Annunciation Panel	
12	SCADA	The Sub-contractor/vendor: i) Should have successful experience in designing, manufacturing, supply, installation, testing & commissioning of Control, Protection and Monitoring Systems comprising integrated Computerized Control System and Numerical Protection System in last 10 years, ending last day of the month previous to the one in which NIT is published.
13	C & R Panel	

		ii) The items/equipment should have been in successful operation at least at three power station/ installations. iii) Should be an ISO certified company. Documentary evidence duly certified by contractor along with the complete details of the company profile be furnished.
14	HT/MV Cable	The Sub-contractor/vendor: i) Should have manufactured and supplied similar equipment at power stations/substation/any government organization. ii) Should be an ISO certified company. Documentary evidence duly certified by contractor along with the complete details of the company profile be furnished.
15	DC Cable	
16	LT AC Power Cable & Control Cables	
17	Instrumentation Cable	
18	Battery	The Sub-contractor/vendor: i) Should have designed, manufactured, supplied and type tested similar size of equipment during last ten (10) years ending last day of the month previous to the one in which NIT is published. ii) The equipment so supplied should have been in successful operation at least at three power stations/sub stations. iii) Should be an ISO certified company. Documentary evidence duly certified by contractor along with the complete details of the company profile be furnished.
19	Battery Charger	
20	Fire Alarm Panel (Microprocessor based)	The Sub-contractor/vendor: i) Should have manufactured, type tested and supplied of items/equipment earlier during last ten (10) years ending last day of the month previous to the one in which NIT is published. ii) The system so supplied should have been in successful installation at least at three power stations/ Substation/Installation. iii) Should be an ISO certified company. Documentary evidence duly certified by contractor along with the complete details of the company profile be furnished.
21	Luminaires	The Sub-contractor/vendor: i) Should have manufactured and supplied similar equipment at power stations/substation/any government organization. ii) Should be an ISO certified company. Documentary evidence duly certified by contractor along with the complete details of the company profile be furnished.

22	OFC/OPGW	The Sub-contractor/vendor: i) Should have manufactured and supplied similar equipment at power stations/substation/any government organization. ii) Should be an ISO certified company. Documentary evidence duly certified by contractor along with the complete details of the company profile be furnished.
23	Complete Tracker System	i) The Sub-vendor should have designed, manufactured, supplied, erected/supervised erection, and commissioned/supervised commissioning Solar Tracker System of the proposed design/type of cumulative capacity of 40 MWp or above, out of which at least one such supply order for a single plant should be of 10 MWp or above capacity. The Sub-Vendor may use the credentials of its Parent/Group/Holding company for meeting the requirement. The reference plant in which 10 MWp or above capacity Solar Tracker System was supplied, must have been in successful operation for at least one (1) year prior to Date of submission of qualification documents to Employer or (LOA date + 6 months), whichever is earlier. ii) The proposed Tracker design/type shall be of proven technology with Independent Engineers Bankability review report from reputable agencies like Black and Veatch, DNV, IITs or other premier institutions/agencies. iii) Documentary evidence duly certified by contractor along with the complete details of the company profile be furnished.

ATTACHMENT - 6

(Name of the Project)

List of Deviations without Cost of Withdrawal

(To be furnished by the Bidders)

(Bidder's Name & Address):

To :.....
(Name of the Employer)

Dear Sir,

Following are the deviations proposed by us as per ITB Clause 22:

S.No.	Clause No.	Deviation	Remarks/Justifications

Note :

1. We hereby confirm that all the deviations specified as above in Attachment – 6 are the same which have been mentioned in Attachment - 6A alongwith its cost of withdrawal and as placed in Envelope – II.

2. We hereby confirm our acceptance and compliance to the critical provisions of GCC clauses listed in ITB clause 22.

Date : ..... (Signature).....

Place : ..... (Printed Name).....

(Designation).....

(CommonSeal).....

ATTACHMENT - 6A

(Name of the Project)

List of Deviations with Cost of Withdrawal

(Bidder's Name & Address):

To :.....

(Employer's Name & Address)

Dear Sir,

Following are the deviations proposed by us as per ITB Clause 22. We are also furnishing below the cost of withdrawal for the deviations proposed by us in Attachment 6. We confirm that we shall withdraw the deviations proposed by us at the cost of withdrawal indicated in this attachment failing which our bid may be rejected and Bid Security forfeited.

Deviations:

S.No.	Clause No.	Deviation	Cost of Withdrawal
1.	2.	3.	4.

Date : ..... (Signature).....

Place : ..... (Printed Name).....

(Designation).....

(CommonSeal).....

ATTACHMENT - 7

The bidder shall submit the Brief Integrated PERT Network (L2 Schedule) in line with the Implementation schedule in SCC Cl. 6.0

Attachment 8

(Detailed Report on Site for Proposed Power Project)

The bidder shall submit a report about the proposed site mentioning the brief detail of land. The Bidder shall submit detailed write-up along with data as sought under various sections of the Bidding Documents.

ATTACHMENT –9

Deleted

ATTACHMENT –10
(Anti Profiteering Certificate)

Undertaking by Bidder towards Anti-profiteering Clause of GST Act / Rules

(To be submitted on letter head)

To,

M/s NHPC Ltd.

Sub.: Tender no.....

Dear Sir,

We, M/s..... **(Name of Bidder)** have submitted bid dt.....for the aforesaid tender.

Section 171 of CGST Act. /SGST Act. stipulates that it is mandatory to pass on the benefit of reduction in rate of tax on supply of Goods or Services or availability of Input Tax Credit, by way of commensurate reduction in prices.

Accordingly, it is certified that we have duly considered the impact of Input Tax Credit available on supplies in the GST regime, in our quoted prices. Further, any additional benefit of ITC if available to bidder shall be passed on to the Employer.

Further, we hereby confirm that our quoted prices are duly considering maximum possible benefit available and are in compliance with the aforesaid Section 171 of CGST Act / IGST Act.

Further if any refund on account of GST is received from the Government in future by the contractor / supplier under any GST refund / Exemption or Subsidy Scheme, the same shall also be passed on to the Employer.

In case this declaration is found faulty in any manner, we shall be fully responsible for the consequential effect including making good of any losses of interest etc. to NHPC Ltd.

[Signature of Authorized Signatory of Bidder]

Place:
Date:

Name:
Designation:
Seal:

ATTACHMENT -11

(HSN / SAC Code for the BOQ items)

Name of work: Setting up of 200 MW Solar PV Power Project in 600 MW in Solar park (Stage-1) of Gujarat State Electricity Corporation Ltd.(GSECL) at Khavda, Gujarat.

Item No.	Item Description	HSN / SAC Code
1	2	3
A.	**For Supply**	
1	**SPV MODULES AND ACCESSORIES**: SPV modules complete with all accessories, Mandatory/Specified spares, Tools & Instruments as per specifications & scope mentioned in Employer's Requirements (Technical Specifications) for E&M Works	
2	**MODULE MOUNTING STRUCTURES (If applicable)**: Module mounting structures complete with all accessories, Mandatory / Specified spares and Tools & Instruments as per specifications & scope mentioned in Employer's Requirements (Technical Specifications) for E&M Works	
3	**POWER CONDITIONING UNITS:** Power Conditioning Units/ Inverters complete with all accessories, Mandatory/Specified spares, Tools & Instruments as per specifications & scope mentioned in Employer's Requirements (Technical Specifications) for E&M Works.	
4	**CABLING SYSTEM:** Cabling System complete with all accessories, Mandatory / Specified spares, Tools & Instruments as per specifications & scope mentioned in Employer's Requirements (Technical Specifications) for E&M Works.	
5	**METEOROLOGICAL MEASURING INSTRUMENTS:** Meteorological Measuring Instruments complete with all accessories, Mandatory / Specified spares, Tools & Instruments as per specifications & scope mentioned in Employer's Requirements (Technical Specifications) for E&M Works.	
6	**STRING COMBINER BOX:** String Combiner Box complete with all accessories, Mandatory/ Specified spares, Tools & Instruments as per specifications & scope mentioned in Employer's Requirements (Technical Specifications) for E&M Works.	

Item No.	Item Description	HSN / SAC Code
1	2	3
7	**SOLAR PLANT TRANSFORMERS AND STATION SUPPLY TRANSFORMER/AUXILIARY TRANSFORMER:** Solar Plant Transformers & Station Supply transformer(s)/ Auxilliary Transformer complete with all accessories, Mandatory / Specified spares, Tools & Instruments as per specifications & scope mentioned in Employer's Requirements (Technical Specifications) for E&M Works.	
8	**DC SYSTEM:** DC System complete with all accessories, Mandatory/ Specified spares, Tools & Instruments as per specifications & scope mentioned in Employer's Requirements (Technical Specifications) for E&M Works	
9	**CONTROL AND MONITORING (SCADA) SYSTEM:** Control & monitoring System including SCADA & Surveillace System (For Solar Plant) complete with all accessories, Mandatory / Specified spares, Tools & Instruments as per specifications & scope mentioned in Employer's Requirements (Technical Specifications) for E&M Works	
10	**PROTECTION SYSTEM:** Protection System complete with all accessories , Mandatory / Specified spares, Tools & Instruments as per specifications & scope mentioned in Employer's Requirements (Technical Specifications) for E&M Works	
11	**33 kV (MV) SWITCHGEAR:** MV System complete with all accessories, Mandatory / Specified spares, Tools & Instruments as per specifications & scope mentioned in Employer's Requirements (Technical Specifications) for E&M Works.	
12	**415 V (LT) SWITCHGEAR:** LT switchgear system complete with all accessories, Mandatory / Specified spares, Tools & Instruments as per specifications & scope mentioned in Employer's Requirements (Technical Specifications) for E&M Works	
13	**ILLUMINATION SYSTEM:** Illumination System complete with all accessories, Mandatory / Specified spares, Tools & Instruments as per specifications & scope mentioned in Employer's Requirements (Technical Specifications) for E&M Works	

Item No.	**Item Description**	**HSN / SAC Code**
1	**2**	**3**
14	**GROUNDING SYSTEM:** Grounding System complete with all accessories, Mandatory / Specified spares, Tools and Instruments as per specifications & scope mentioned in Employer's Requirements (Technical Specifications) for E&M Works	
15	**FIRE PROTECTION & FIRE FIGHTING SYSTEM:** Fire Protection & Fire fighting System complete with all accessories, Mandatory / Specified spares, Tools & Instruments as per specifications & scope mentioned in Employer's Requirements (Technical Specifications) for E&M Works	
B.	**Providing all services for Local Transportation, Port handling, Insurance, Erection, Testing and Commissioning**	
1	Providing all services i.e. insurance, inland transportation for delivery at site including storage, handling at site, installation, testing and commissioning of plant including transmission network and integration with the grid including all other civil works and land development including statutory approvals, permits, license etc. Complete in all respect.	
C.	**For Comprehensive Operation and Maintenance**	
1	Comprehensive operation and maintenance for a period of 05 years including 24 months of defect liability period from the date of commissioning of the solar power project.	

ATTACHMENT-12

DECLARATION REGARDING INSOLVENCY PROCEEDINGS UNDER INSOLVENCY AND BANKRUPTCY CODE 2016

Subject: **Setting up of 200 MW Solar PV Power Project in 600 MW in Solar park (Stage-1) of Gujarat State Electricity Corporation Ltd.(GSECL) at Khavda, Gujarat.**

It is declared that "no insolvency proceeding is admitted by the Adjudicating Authority against ……. (name of the bidder / partner of JV / Parent Holding Company / Sub-Contractor) under the IBC 2016".

Further, it is declared that after submitting the bid till the time of award of work, ……. (name of the bidder / partner of JV / Parent Holding Company / Sub-Contractor) shall inform NHPC regarding any admission of application for corporate insolvency resolution process by the Adjudicating Authority under the IBC 2016 against ……. (Name of the bidder / partner of JV / Parent Holding Company / Sub-Contractor) and any suppression of such fact shall render the ……. (name of the bidder / partner of JV / Parent Holding Company / Sub-Contractor) liable for rejection of our bid and banning of business dealing as per terms and conditions of Guidelines of banning of business dealings under Integrity Pact.

(To be submitted on letter head duly signed by the authorized representative of bidder/each partner of JV/Consortium/ Parent Company/Sub-contractor)

{REFER Clause 37 OF ITB}

ATTACHMENT-13

Self-Certificate for Cyber Security

We declare that cyber security/ safety of the equipment/ process to be supplied / services to be rendered as safe to connect.

Note:

1. All the items/components/services specified under the Contract shall be supplied in compliance to cyber security policies/guidelines of the buyer organisation/GoI guidelines..

2. We shall strictly follow the order from Ministry of Power (Government of India) Circular No.25-l l/6/2018-PG Dated 02.07.2020 and Circular No. 12/34/2020-T&R dated 08.06.2021 (along with its ammendments issued from time to time) during procurement of any equipments / hardware to be used in power supply system, network and/or associated IT / OT/ IoT infrastructure.

(Seal & Signature of Bidder)

Date:

PRICE SCHEDULES

Validate Print Help

Item Rate BoQ

Tender Inviting Authority: General Manager (CC-III), NHPC Limited, NHPC Office Complex, Sector-33, Faridabad.

Name of Work: Setting up of 200 MW Solar PV Project in 600 MW in Solar Park (Stage-1) of Gujarat State Electricity Corporation Ltd. (GSECL) at Khavda, Gujarat.

Tender Reference No: NH/CCW/CC-III/CO-258/PR16923/8 **Tender ID: 2023_NHPC_760763_1**

Name of the Bidder/ Bidding Firm / Company :	

Price Schedule No. 1: Schedule of Price for "Supply of Plant & equipment including Specified spares, tools and instruments complete in all respect"

(This BOQ template must not be modified/replaced by the bidder and the same should be uploaded after filling the relevent columns, else the bidder is liable to be rejected for this tender. Bidders are allowed to enter the Bidder Name and Values only)

Note-1: The price quoted shall include all applicable taxes as on 28 days prior to Bid Submission Date.
Note 2: The price quoted shall be after taking into account the input tax credit and other benefits.
Note 3: The bidder shall clearly specify the HSN/SAC codes for the items at the places specified in the bid. Any tax applicable but not quoted by the bidder shall be deemed to be included in the all inclusive rates quoted by the bidder.
Note 4: The Price Bid shall be duly filled in excel sheet in conformity with the tender specification on the e-procurement portal only. The calculation of amount by multiplying the quantities with the rates filled in by the bidder, sub-totals, total etc. shall be done by formulae already provided in electronic form. In case of any discrepancy in the calculations, the rates shall be considered final and the amount calculated by using the same shall be corrected and considered as final. Where ever a price for items is left blank, in the BOQ, it shall be deemed to have been included in other items.
Note 5: Any technical parameters indicated above are for reference only. Bidder shall refer the technical specifications for details.
Note 6: Any item not mentioned in the above particulars but written elsewhere in the scope of work or in Employer's Requirement (Technical Specifications) or in MNRE Guideline or essentially required for completion of works, proper operation and maintenance of Solar Power Plant , safety of equipment and operating personnel shall be deemed to have been included in the above particulars.

NUMBER #	TEXT #	NUMBER #	TEXT #	NUMBER #	NUMBER #	TEXT #
Sl. No.	Item Description	Quantity	Units	RATE (including Taxes) in Figures To be entered by the Bidder in INR	TOTAL AMOUNT (including all Taxes) in INR	TOTAL AMOUNT In Words
1	2	3	4	5	6	7

1	**SPV MODULES AND ACCESSORIES**: SPV modules with all accessories, Mandatory/Specified spares, Tools & Instruments as per specifications & scope mentioned in Employer's Requirements (Technical Specifications) for E&M Works	1	Lot		**0.00**	INR Zero Only
2	**MODULE MOUNTING STRUCTURES:** Module mounting structures with all accessories, Mandatory / Specified spares and Tools & Instruments as per specifications & scope mentioned in Employer's Requirements (Technical Specifications) for E&M Works	1	Lot		**0.00**	INR Zero Only
3	**POWER CONDITIONING UNITS**: Power Conditioning Units/ Inverters with all accessories, Mandatory/Specified spares, Tools & Instruments as per specifications & scope mentioned in Employer's Requirements (Technical Specifications) for E&M Works.	1	Lot		**0.00**	INR Zero Only
4	**CABLING SYSTEM:** Cabling System with all accessories, Mandatory / Specified spares, Tools & Instruments as per specifications & scope mentioned in Employer's Requirements (Technical Specifications) for E&M Works.	1	Lot		**0.00**	INR Zero Only
5	**METEOROLOGICAL MEASURING INSTRUMENTS**: Meteorological Measuring Instruments with all accessories, Mandatory / Specified spares, Tools & Instruments as per specifications & scope mentioned in Employer's Requirements (Technical Specifications) for E&M Works.	1	Lot		**0.00**	INR Zero Only
6	**STRING COMBINER BOX:** String Combiner Box with all accessories, Mandatory/ Specified spares, Tools & Instruments as per specifications & scope mentioned in Employer's Requirements (Technical Specifications) for E&M Works.	1	Lot		**0.00**	INR Zero Only

7	**SOLAR PLANT TRANSFORMERS (INVERTER DUTY TRANSFORMER) AND STATION SUPPLY TRANSFORMER/ AUXILIARY TRANSFORMER:** Solar Plant Transformers & Station Supply transformer(s)/Auxiliary Transformer with all accessories, Mandatory / Specified spares, Tools & Instruments as per specifications & scope mentioned in Employer's Requirements (Technical Specifications) for E&M Works.	1	Lot		**0.00**	INR Zero Only
8	**DC SYSTEM**: DC System with all accessories, Mandatory/ Specified spares, Tools & Instruments as per specifications & scope mentioned in Employer's Requirements (Technical Specifications) for E&M Works	1	Lot		**0.00**	INR Zero Only
9	**CONTROL AND MONITORING (SCADA) SYSTEM**: Control & monitoring System including SCADA with all accessories, Mandatory / Specified spares, Tools & Instruments as per specifications & scope mentioned in Employer's Requirements (Technical Specifications) for E&M Works	1	Lot		**0.00**	INR Zero Only
10	**PROTECTION SYSTEM**: Protection System with all accessories , Mandatory / Specified spares, Tools & Instruments as per specifications & scope mentioned in Employer's Requirements (Technical Specifications) for E&M Works	1	Lot		**0.00**	INR Zero Only
11	**33 kV (MV) SWITCHGEAR**: MV System along with all accessories, Mandatory / Specified spares, Tools & Instruments as per specifications & scope mentioned in Employer's Requirements (Technical Specifications) for E&M Works.	1	Lot		**0.00**	INR Zero Only
12	**415 V (LT) SWITCHGEAR**: LT switchgear system with all accessories, Mandatory / Specified spares, Tools & Instruments as per specifications & scope mentioned in Employer's Requirements (Technical Specifications) for E&M Works	1	Lot		**0.00**	INR Zero Only

13	**ILLUMINATION SYSTEM**: Illumination System with all accessories, Mandatory / Specified spares, Tools & Instruments as per specifications & scope mentioned in Employer's Requirements (Technical Specifications) for E&M Works	1	Lot		**0.00**	INR Zero Only
14	**GROUNDING SYSTEM:** Grounding System complete with all accessories, Mandatory / Specified spares, Tools and Instruments as per specifications & scope mentioned in Employer's Requirements (Technical Specifications) for E&M Works	1	Lot		**0.00**	INR Zero Only
15	**FIRE PROTECTION & FIRE FIGHTING SYSTEM:** Fire Protection & Fire fighting System complete with all accessories, Mandatory / Specified spares, Tools & Instruments as per specifications & scope mentioned in Employer's Requirements (Technical Specifications) for E&M Works	1	Lot		**0.00**	INR Zero Only
Total in Figures					**0.00**	INR Zero Only
Quoted Rate in Words		**INR Zero Only**				

Validate Print Help

Item Rate BoQ

Tender Inviting Authority: General Manager (CC-III), NHPC Limited, NHPC Office Complex, Sector-33, Faridabad.

Name of Work: Setting up of 200 MW Solar PV Project in 600 MW in Solar Park (Stage-1) of Gujarat State Electricity Corporation Ltd. (GSECL) at Khavda, Gujarat.

Tender Reference No: NH/CCW/CC-III/CO-258/PR16923/8 **Tender ID: 2023_NHPC_760763_1**

Name of the Bidder/ Bidding Firm / Company :	

Price Schedule No. 2: Schedule of Price for "Providing Installation, Testing & Commissioning of Plant including Transmission Network including all services i.e storage, handling at Site, including all other Civil Works, Land Development including statutory approval, permits, license etc. complete in all respect" for Solar PV Power Plant.

(This BOQ template must not be modified/replaced by the bidder and the same should be uploaded after filling the relevent columns, else the bidder is liable to be rejected for this tender. Bidders are allowed to enter the Bidder Name and Values only)

Note-1: The price quoted shall include all applicable taxes as on 28 days prior to Bid Submission Date.
Note 2: The price quoted shall be after taking into account the input tax credit and other benefits.
Note 3: The bidder shall clearly specify the HSN/SAC codes for the items at the places specified in the bid. Any tax applicable but not quoted by the bidder shall be deemed to be included in the all inclusive rates quoted by the bidder.
Note 4: The Price Bid shall be duly filled in excel sheet in conformity with the tender specification on the e-procurement portal only. The calculation of amount by multiplying the quantities with the rates filled in by the bidder, sub-totals, total etc. shall be done by formulae already provided in electronic form. In case of any discrepancy in the calculations, the rates shall be considered final and the amount calculated by using the same shall be corrected and considered as final. Where ever a price for items is left blank, in the BOQ, it shall be deemed to have been included in other items.
Note 5: Any technical parameters indicated above are for reference only. Bidder shall refer the technical specifications for details.
Note 6: Any item not mentioned in the above particulars but written elsewhere in the scope of work or in Employer's Requirement (Technical Specifications) or in MNRE Guideline or essentially required for completion of works, proper operation and maintenance of Solar Power Plant , safety of equipment and operating personnel shall be deemed to have been included in the above particulars.

NUMBER #	TEXT #	NUMBER #	TEXT #	NUMBER #	NUMBER #	TEXT #
Sl. No.	Item Description	Quantity	Units	RATE (including Taxes) in Figures To be entered by the Bidder in INR	TOTAL AMOUNT (including all Taxes) in INR	TOTAL AMOUNT In Words
1	2	3	4	5	6	7

1	**SPV MODULES AND ACCESSORIES**: SPV modules with all accessories, Mandatory/Specified spares, Tools & Instruments as per specifications & scope mentioned in Employer's Requirements (Technical Specifications) for E&M Works	1	Lot		**0.00**	INR Zero Only
2	**MODULE MOUNTING STRUCTURES:** Module mounting structures with all accessories, Mandatory / Specified spares and Tools & Instruments as per specifications & scope mentioned in Employer's Requirements (Technical Specifications) for E&M Works	1	Lot		**0.00**	INR Zero Only
3	**POWER CONDITIONING UNITS**: Power Conditioning Units/ Inverters with all accessories, Mandatory/Specified spares, Tools & Instruments as per specifications & scope mentioned in Employer's Requirements (Technical Specifications) for E&M Works.	1	Lot		**0.00**	INR Zero Only
4	**CABLING SYSTEM**: Cabling System with all accessories, Mandatory / Specified spares, Tools & Instruments as per specifications & scope mentioned in Employer's Requirements (Technical Specifications) for E&M Works.	1	Lot		**0.00**	INR Zero Only
5	**METEOROLOGICAL MEASURING INSTRUMENTS:** Meteorological Measuring Instruments with all accessories, Mandatory / Specified spares, Tools & Instruments as per specifications & scope mentioned in Employer's Requirements (Technical Specifications) for E&M Works.	1	Lot		**0.00**	INR Zero Only
6	**STRING COMBINER BOX:** String Combiner Box with all accessories, Mandatory/ Specified spares, Tools & Instruments as per specifications & scope mentioned in Employer's Requirements (Technical Specifications) for E&M Works.	1	Lot		**0.00**	INR Zero Only

7	**SOLAR PLANT TRANSFORMERS (INVERTER DUTY TRANSFORMER) AND STATION SUPPLY TRANSFORMER/ AUXILIARY TRANSFORMER:** Solar Plant Transformers & Station Supply transformer(s)/Auxiliary Transformer with all accessories, Mandatory / Specified spares, Tools & Instruments as per specifications & scope mentioned in Employer's Requirements (Technical Specifications) for E&M Works.	1	Lot		**0.00**	INR Zero Only
8	**DC SYSTEM:** DC System with all accessories, Mandatory/ Specified spares, Tools & Instruments as per specifications & scope mentioned in Employer's Requirements (Technical Specifications) for E&M Works	1	Lot		**0.00**	INR Zero Only
9	**CONTROL AND MONITORING (SCADA) SYSTEM**: Control & monitoring System including SCADA with all accessories, Mandatory / Specified spares, Tools & Instruments as per specifications & scope mentioned in Employer's Requirements (Technical Specifications) for E&M Works	1	Lot		**0.00**	INR Zero Only
10	**PROTECTION SYSTEM**: Protection System with all accessories , Mandatory / Specified spares, Tools & Instruments as per specifications & scope mentioned in Employer's Requirements (Technical Specifications) for E&M Works	1	Lot		**0.00**	INR Zero Only
11	**33 kV (MV) SWITCHGEAR:** MV System along with all accessories, Mandatory / Specified spares, Tools & Instruments as per specifications & scope mentioned in Employer's Requirements (Technical Specifications) for E&M Works.	1	Lot		**0.00**	INR Zero Only
12	**415 V (LT) SWITCHGEAR:** LT switchgear system with all accessories, Mandatory / Specified spares, Tools & Instruments as per specifications & scope mentioned in Employer's Requirements (Technical Specifications) for E&M Works	1	Lot		**0.00**	INR Zero Only

13	**ILLUMINATION SYSTEM:** Illumination System with all accessories, Mandatory / Specified spares, Tools & Instruments as per specifications & scope mentioned in Employer's Requirements (Technical Specifications) for E&M Works	1	Lot		**0.00**	INR Zero Only
14	**GROUNDING SYSTEM**: Grounding System complete with all accessories, Mandatory / Specified spares, Tools and Instruments as per specifications & scope mentioned in Employer's Requirements (Technical Specifications) for E&M Works	1	Lot		**0.00**	INR Zero Only
15	**FIRE PROTECTION & FIRE FIGHTING SYSTEM:** Fire Protection & Fire fighting System complete with all accessories, Mandatory / Specified spares, Tools & Instruments as per specifications & scope mentioned in Employer's Requirements (Technical Specifications) for E&M Works Including statutory approvals, permits, licenses,Testing, Calibration, study, modelling etc.required during construction & for commissioning of the Plant.	1	Lot		**0.00**	INR Zero Only
16	**Civil and Allied works**					
16.01	GEO-TECHNICAL INVESTIGATIONS AND TESTING	1	Lumpsum		**0.00**	INR Zero Only
16.02	SITE DEVELOPMENT	1	Lumpsum		**0.00**	INR Zero Only
16.03	APPROACH ROADS,SERVICE ROADS AND PATHWAYS	1	Lumpsum		**0.00**	INR Zero Only
16.04	SOLAR PLANT PERIPHERAL BOUNDARY	1	Lumpsum		**0.00**	INR Zero Only
16.05	FENCING OF TRANSFORMER YARD INCLUDING GATES	1	Lumpsum		**0.00**	INR Zero Only
16.06	SECURITY CABIN/GUARD ROOM	1	Lumpsum		**0.00**	INR Zero Only
16.07	FOUDATION OF TRANSFORMERS ETC.	1	Lumpsum		**0.00**	INR Zero Only
16.08	FOUNDATION OF MODULES	1	Lumpsum		**0.00**	INR Zero Only

16.09	LAYING OF EARTHING SYSTEM	1	Lumpsum		**0.00**	INR Zero Only
16.10	CONTROL ROOM	1	Lumpsum		**0.00**	INR Zero Only
16.11	INVERTER ROOM	1	Lumpsum		**0.00**	INR Zero Only
16.12	CABLE TRENCHES	1	Lumpsum		**0.00**	INR Zero Only
16.13	DRAINAGE SYSTEM	1	Lumpsum		**0.00**	INR Zero Only
16.14	SERVICE WATER SUPPLY SYSTEM	1	Lumpsum		**0.00**	INR Zero Only
16.15	MODULE CLEANING ARRANGEMENTS	1	Lumpsum		**0.00**	INR Zero Only
16.16	PARKING SHED AND STORE SHED	1	Lumpsum		**0.00**	INR Zero Only
Total in Figures					**0.00**	INR Zero Only
Quoted Rate in Words				**INR Zero Only**		

Validate Print Help

Item Rate BoQ

Tender Inviting Authority: General Manager (CC-III), NHPC Limited, NHPC Office Complex, Sector-33, Faridabad.

Name of Work: Setting up of 200 MW Solar PV Project in 600 MW in Solar Park (Stage-1) of Gujarat State Electricity Corporation Ltd. (GSECL) at Khavda, Gujarat.

Tender Reference No: NH/CCW/CC-III/CO-258/PR16923/8 **Tender ID: 2023_NHPC_760763_1**

Name of the Bidder/ Bidding Firm / Company :	

Price Schedule No. 3: Schedule of Price for Comprehensive operation and maintenance including all statutory approval, permits, license, testing, caliberation etc. in respect of all the equipment supplied under the Price Schedule First and any other Services specified in the Contract Documents (Price Schedule Second) for 05 years from commissioning of Plant and Annual Maintenance Contract (AMC) of the equipments (Hereinafter referred as O &M Schedule).

(This BOQ template must not be modified/replaced by the bidder and the same should be uploaded after filling the relevent columns, else the bidder is liable to be rejected for this tender. Bidders are allowed to enter the Bidder Name and Values only)

Note-1: The price quoted shall include all applicable taxes as on 28 days prior to Bid Submission Date.
Note 2: The price quoted shall be after taking into account the input tax credit and other benefits.
Note 3: The bidder shall clearly specify the HSN/SAC codes for the items at the places specified in the bid. Any tax applicable but not quoted by the bidder shall be deemed to be included in the all inclusive rates quoted by the bidder.
Note 4: The Price Bid shall be duly filled in excel sheet in conformity with the tender specification on the e-procurement portal only. The calculation of amount by multiplying the quantities with the rates filled in by the bidder, sub-totals, total etc. shall be done by formulae already provided in electronic form. In case of any discrepancy in the calculations, the rates shall be considered final and the amount calculated by using the same shall be corrected and considered as final. Where ever a price for items is left blank, in the BOQ, it shall be deemed to have been included in other items.
Note 5: Any technical parameters indicated above are for reference only. Bidder shall refer the technical specifications for details.
Note 6: Any item not mentioned in the above particulars but written elsewhere in the scope of work or in Employer's Requirement (Technical Specifications) or in MNRE Guideline or essentially required for completion of works, proper operation and maintenance of Solar Power Plant & Park, safety of equipment and operating personnel shall be deemed to have been included in the above particulars.

NUMBER #	TEXT #	NUMBER #	TEXT #	NUMBER #	NUMBER #	TEXT #
Sl. No.	Item Description	Quantity	Units	RATE (including Taxes) in Figures To be entered by the Bidder in INR	TOTAL AMOUNT (including all Taxes) in INR	TOTAL AMOUNT In Words
1	2	3	4	5	6	7

1	COMPREHENSIVE OPERATION & MAINTENANCE OF COMPLETE SOLAR PV POWER PLANT INCLUDING ALL STATUTORY APPROVAL, PERMITS, LICENSE, TESTING, CALIBRATION ETC IN RESPECT OF ALL THE EQUIPMENT SUPPLIED UNDER THE 'FIRST PRICE SCHEDULE' AND ANY OTHER SERVICES SPECIFIED IN THE CONTRACT DOCUMENTS (SECOND PRICE SCHEDULE) FOR FIVE YEARS FROM COMMISSIONING OF THE PLANT AND ANNUAL MAINTENANCE CONTRACT (AMC) OF THE EQUIPMENTS (HEREINAFTER REFERRED AS O&M Schedule).	1	Lot		**0.00**	INR Zero Only
Total in Figures					**0.00**	INR Zero Only
Quoted Rate in Words		**INR Zero Only**				

Validate Print Help

Tender Inviting Authority: General Manager (CC-III), NHPC Limited, NHPC Office Complex, Sector-33, Faridabad.

Name of Work: Setting up of 200 MW Solar PV Project in 600 MW in Solar Park (Stage-1) of Gujarat State Electricity Corporation Ltd. (GSECL) at Khavda, Gujarat.

Tender Reference No: NH/CCW/CC-III/CO-258/PR16923/8 **Tender ID: 2023_NHPC_760763_1**

Name of the Bidder/ Bidding Firm / Company :	

Price Schedule No. 4: Schedule of Price for "GRAND SUMMARY".

(This BOQ template must not be modified/replaced by the bidder and the same should be uploaded after filling the relevent columns, else the bidder is liable to be rejected for this tender. Bidders are allowed to enter the Bidder Name and Values only)

Notes:

1. This schedule shall be obtained as per excel calculations based on the prices quoted by the bidders in Price Schedules 1 to 3.

2. The Price Bid shall be duly filled in excel sheet in conformity with the tender specification on the e-procurement portal only. The calculation of amount by multiplying the quantities with the rates filled in by the bidder, sub-totals, total etc. shall be done by formulae already provided in electronic form. In case of any discrepancy in the calculations, the rates shall be considered final and the amount calculated by using the same shall be corrected and considered as final. Where ever prices for items is left blank, in the BOQ, it shall be deemed to have been included in other items.

NUMBER #	TEXT #	NUMBER #	NUMBER #	TEXT #
Sl. No.	Item Description	TOTAL AMOUNT (including Taxes) in figures (shall be obtained from respective Schedules using spreadsheet calculations.	TOTAL AMOUNT With Taxes in figures	TOTAL AMOUNT Including taxes In Words
1	2	3	4	5
1	**Total of Schedule 1**	**0.00**	**0.00**	INR Zero Only
2	**Total of Schedule 2**	**0.00**	**0.00**	INR Zero Only
3	**Total of Schedule 3**	**0.00**	**0.00**	INR Zero Only
Total in Figures			**0.00**	INR Zero Only
Quoted Rate in Words		**INR Zero Only**		

Validate Print Help

Item Rate BoQ

Tender Inviting Authority: General Manager (CC-III), NHPC Limited, NHPC Office Complex, Sector-33, Faridabad.

Name of Work: Setting up of 200 MW Solar PV Project in 600 MW in Solar Park (Stage-1) of Gujarat State Electricity Corporation Ltd. (GSECL) at Khavda, Gujarat.

Tender Reference No: NH/CCW/CC-III/CO-258/PR16923/8 **Tender ID: 2023_NHPC_760763_1**

Name of the Bidder/ Bidding Firm / Company :	

Price Schedule No. 5: Schedule for "Total Generation in Units" as quoted by the Bidder (for First Year in kWh).

(This BOQ template must not be modified/replaced by the bidder and the same should be uploaded after filling the relevent columns, else the bidder is liable to be rejected for this tender. Bidders are allowed to enter the Bidder Name and Values only)

Notes:

Note 1: Bidders are required to fill up "Total Generation in Units" as defined in Technical Data Sheets.
Note 2: The "Total Generation in Units (For First Year in kWh)", shall be quoted by the Bidder under price Schedule -5. The value of quoted "Total Generation in Units" (for first year in kWh) MGG shall not be less than 474,00,00,00 kWh and should not be greater than 498,00,00,00 Kwh
Note 3: The "Total Generation in Units" as above shall remain unchanged and the bidders shall not be allowed to alter / modify it during entire bidding process including e-Reverse Auction.
Note 4: In case of non-conformity of "Total Generation in Units" with the above conditions, the bid shall be rejected and bid security shall be forfeited.

NUMBER #	TEXT #	TEXT #	NUMBER #	NUMBER #

Sl. No.	Item Description	Units	QUANTITY (In Figures To be entered by the Bidder)	TOTAL QUANTITY
1	2	3	4	5
1	**TOTAL GENERATION IN UNITS**	kWh		**0.00**
Total in Figures				**0.00**

Validate Print Help se BoQ

Tender Inviting Authority: General Manager (CC-III), NHPC Limited, NHPC Office Complex, Sector-33, Faridabad.

Name of Work: Setting up of 200 MW Solar PV Project in 600 MW in Solar Park (Stage-1) of Gujarat State Electricity Corporation Ltd. (GSECL) at Khavda, Gujarat.

Tender Reference No: NH/CCW/CC-III/CO-258/PR16923/8 **Tender ID: 2023_NHPC_760763_1**

Name of the Bidder/ Bidding Firm / Company :	

Price Schedule No. 6: Bid Price per units of Generation i.e. Price Schedule -4: Grand Summary divided by Generation in Units quoted by the Bidder under Price Schedule - 5.

(This BOQ template must not be modified/replaced by the bidder and the same should be uploaded after filling the relevent columns, else the bidder is liable to be rejected for this tender. Bidders are allowed to enter the Bidder Name and Values only)

Notes:

Note 1: This schedule shall be obtained as per excel calculations based on the prices quoted by the bidders in Price Schedules 1 to 3 & Total Generation in Units as provided in Schedule-5.
Note 2: Bidders are required to fill up their Bid Prices in Price Schedule 1 to 3 from which "Price Bid (Schedule-4: Grand Summary)" shall be obtained as per excel calculations. Bidders are required to fill up their "Total Generation in Units" in Price Schedule 5. The "Total Generation in Units" shall remain unchanged and the bidders shall not be allowed to alter/ modify it during entire bidding process including e-Reverse Auction.
Note 3: "Bid Price per Units of Generation" shall be calculated in excel in Price Schedule No.6 which shall be the "Price Bid (Schedule- 4: Grand Summary)" divided by "Total Generation in Units" quoted by the Bidder in Price Schedule - 5

NUMBER #	TEXT #	NUMBER #

Sl. No.	Item Description	In Figures
1	2	3
1	**TOTAL OF SCHEDULE NO. 4 (GRAND SUMMARY) in INR**	**0.00**
2	**TOTAL GENERATION IN UNITS AS PER PRICE SCHEDULE – 5**	**0.00**
3	**BID PRICE PER UNITS OF GENERATION (INR/kWh) (For First Year in kWh)**	**0.0000**

2. FORM OF 'NOTIFICATION OF AWARD' OF Setting up of 200 MW Solar PV Power Project in 600 MW in Solar park (Stage-1) of Gujarat State Electricity Corporation Ltd. (GSECL) at Khavda, Gujarat

Ref. No. :

Date:

..... (Contractor's Name & Address).....
.....
.....
.....

Attn: Mr.....

Sub: Notification of Award of Contract for Setting up of 200 MW Solar PV Power Project in 600 MW in Solar park (Stage-1) of Gujarat State Electricity Corporation Ltd. (GSECL) at Khavda, Gujarat..... *(Package Name)*..... as per Specification No.....(

Dear Sir,

1.0 This has reference to the following:

i) Bidding Documents for the subject package issued to you vide our letter no. ..... dated..... comprising the following :

.....(List out all the Sections/Volumes of the Bidding Documents along with Tender Drawings etc. as issued to the bidder).....

Errata/Amendment No..... to..... ***(Name of Section/Volume of the Bidding Documents to which Errata/Amendment pertains).....*** issued to you vide our letter no. .....dated.....

(Applicable only if any Errata/Amendment to the Bidding Documents has been issued subsequently)

ii) Clarifications furnished to you on the Bidding Documents vide our letter no..... dated ..... based on the query raised by **you/one of the prospective bidders.** ***(Use as applicable)***

(Applicable only if any clarification to the Bidding Documents has been issued subsequently)

(INCLUDE AS FURTHER SUB-PARAGRAPHS ANY OTHER CORRESPONDENCE MADE TO THE BIDDER AFTER ISSUANCE OF BIDDING DOCUMENTS UP TO BID OPENING)

iii) Your Proposal for the subject package submitted vide your Letter No. ..... Dated..... **and its modification vide letter no. ..... Dated.....** ***(Delete if not applicable).***

iv) Our Fax message/letter No. ..... dated..... regarding extension of validity of bid and that of the Bank Guarantee towards Bid Security.

i. ***(Applicable only if any extension has been sought subsequently)***

ii. ***(INCLUDE AS FURTHER SUB-PARAGRAPHS ANY OTHER CORRESPONDENCE MADE TO OR BY THE BIDDER AFTER BID OPENING)***

v) Our Fax message/letter No. ..... dated..... inviting you for post bid discussions.

vi) Post bid discussions and meetings we had with you from ..... to .....:

vii) Clarification/Confirmation furnished by you vide your letter No. .....dated .....

2.0 We confirm having accepted your proposal submitted vide letter no. ..... dated ..... **and its modification vide letter no..... dated** ***(Delete if not applicable)*** read in conjunction with all the specifications, terms & conditions of the Bidding Documents and **Your subsequent letters** ***(Use if relevant)*** referred to in para 1.0 above and award on you the Contract for the work of ..... ***(Indicate brief Scope of Work)***.....of..... ***(Name of Package)*** . **Setting up of 200 MW Solar PV Power Project in 600 MW in Solar park (Stage-1) of Gujarat State Electricity Corporation Ltd. (GSECL) at Khavda, Gujarat**.....for***)***..... as per Specification No. :..... .

3.0 It is also expressly understood and agreed by you that the equipment/materials to be supplied by you when installed and commissioned ' for the proposed project shall give satisfactory performance in accordance with the provisions of the Contract.

4.0 The total Price for the entire scope of work under the Contract shall be..... ***(Specify the amount and currency)*****.....**as per the following break up:

(i) **Price for all items Schedule I (Supply for Project)**
(ii) **Price for Schedule II (Installation & Civil work for Project)**
(iii) **Price for Schedule-III (O&M for Project)**
…….....….....
Type test charges .....
TOTAL (i + ii+iii)
.....

(..... ***(Specify the total amount in words)***.....)

5.0 The time for completion of work as per **is 15 (Fifteen) months** for EPC portion of the Contract and 05 years for comprehensive O & M period as mentioned in the contract as per Appendix 4(1)(a) in terms of GCC clause-8.

6.0 The employer shall prepare and finalize the Contract Documents for signing of the formal Contract Agreement as per the Proforma enclosed in the Bidding Documents. Within 28 days of notice of receipt of notice of readiness of contract agreement by the employer, you shall

enter into the Contract Agreement with Employer on non-judicial stamp paper of appropriate value. Till signing of Contract Agreement between Employer and successful bidder, provisions under Clause 6.3 (Arbitration) of GCC shall not be applicable.

7.0 You are requested to submit duly executed Integrity Pact on Non-Judicial Stamp paper of appropriate value prior to signing of Contract Agreement in terms of ITB Clause 33 and Performance Security in the form of Bank Guarantee within 28 days of notification of Contract Award in terms of GCC Clause 13.3.1.

8.0 This Notification of Award is being issued to you in duplicate. We request you to return its duplicate copy duly signed and stamped on each page including all the enclosed Appendices, by the authorized signatory of your company as a proof of your acknowledgement and confirmation.

Please take the necessary action to commence the work and confirm action.

Yours faithfully,
For and on behalf of

..... ***(Name of the Employer).....***
(Authorized Signatory)

Encl.:

3. Form of Contract Agreement

(To be executed on non-judicial Stamp paper of appropriate value)

THIS AGREEMENT is made on the _____day of_____, 20____

BETWEEN

(1) [Name of Employer], a corporation incorporated under the laws of [country of Employer] and having its principal place of business at [address of Employer] (hereinafter called "the Employer" which expression shall unless repugnant to the context or meaning thereof include its successors and assigns) ,) of the one part and (2) [name of Contractor], a Company incorporated under the laws of [country of Contractor] and having its principal place of business at [address of Contractor] (hereinafter called "the Contractor", which expression shall unless repugnant to the context or meaning thereof, include its successors and permitted assigns) of the other part.

WHEREAS the Employer desires to engage the Contractor for…… (Name of Works)……. and has accepted the Bid of the Contractor for the execution and completion of such Works and the remedying of any defects therein at the cost of ------- (Rupees----------).the Contractor have agreed to such engagement upon and subject to the terms and conditions hereinafter appearing.

NOW IT IS HEREBY AGREED as follows:

Article 1.
Contract Documents

1.1 **Contract Documents (Reference GCC Clause 2)**

The following documents shall constitute the Contract between the Employer and the Contractor, and each shall be read and construed as an integral part of the Contract:

(a) This Contract Agreement
(b) Notification of Award
(c) Special Conditions of Contract
(d) General Conditions of Contract
(e) Employer's Requirements (Technical Specifications)
(f) Procedures (as listed)
(g) Technical Data Sheets
(h) Information for Bidders
(i) The Bid and Price Schedules submitted by the Contractor

1.2 **Order of Precedence** (Reference GCC Clause 2)

In the event of any ambiguity or conflict between the Contract Documents listed above, the order of precedence shall be the order in which the Contract Documents are listed in Article 1.1 (Contract Documents) above.

1.3 **Definitions** (Reference GCC Clause 1)

Capitalized words and phrases used herein shall have the same meanings as are respectively assigned to them in the General Conditions of Contract.

Article 2. Contract Price and Terms of Payment

2.1 **Contract Price** (Reference GCC Clause 11)

The Employer hereby agrees to pay to the Contractor the Contract Price in consideration of the performance by the Contractor of its obligations hereunder.
The Contract Price for ……the complete scope of the work under this contract shall be the aggregate of:…… (Amount in Figures)…….(Amount in Words)……. Or such other sums as may be determined in accordance with the terms and conditions of the contract.

2.2 **Terms of Payment** (Reference GCC Clause 12)

The terms and procedures of payment according to which the Employer will reimburse the Contractor are given in Appendix 1 (Terms and Procedures of Payment) hereto.

Article 3. Effective Date for Determining Time for Completion

3.1 **Effective Date** (Reference GCC Clause 1)

The Time of Completion of the Facilities shall be **reckoned from the start date as mentioned in Letter of Award as defined in Appendix-4 (Time Schedules).**

In consideration of the payments to be made by the Employer to the Contractor as hereinafter mentioned, the Contractor hereby covenants with the Employer to execute and complete the Works and remedy the defects therein in conformity in all respect in accordance with the provisions of the Contract.

The Employer hereby covenants to pay the Contractor in consideration of the execution and completion of the works and remedying of defects therein the Contract Price or such other sum as may become payable under the provisions of the Contract at the time and in the manner prescribed by the Contract.

Article 4

It is expressly understood and agreed by and between the Contractor and the Employer that the Employer is entering into this Agreement solely on its own behalf and not on behalf of any other person or entity. In particular it is expressly understood and agreed that the Government of India is not a party to this Agreement and has no liabilities, obligations or rights hereunder. It is expressly understood and agreed that the Employer is an Independent legal entity with power and authority to enter into contracts solely on its own behalf under the applicable laws of India and the general principles of Contract Law. The Contractor expressly agrees, acknowledges and understands that the Employer is not an Agent, Representative or Delegate of the Govt. of India. It is further understood and agreed that the Government of India is not and shall not be liable for any acts, omissions, commissions, breaches or other wrongs arising out of the Contract. Accordingly, the Contractor expressly waives, releases and foregoes any and all actions or claims, including cross claims, impleader claims or counter claims against the Government of India arising out of this Contract and covenants not to sue the Government of India as to any manner, claim, cause of action or thing whatsoever arising of or under this Agreement.

Article 5. Appendices

The Appendices listed in the attached list of Appendices shall be deemed to form an integral part of this Contract Agreement.

Reference in the Contract to any Appendix shall mean the Appendices attached hereto, and the Contract shall be read and construed accordingly.

IN WITNESS WHEREOF the Employer and the Contractor have caused this Agreement to be duly executed by their duly authorized representatives the day and year first above written.

Signed by for and on behalf of the Employer

_____

[*Signature*]

_____

[*Title*]

in the presence of _____

Signed by for and on behalf of the Contractor

_____

[Signature]

_____

[Title]

in the presence of _____

AGREEMENT

dated the _____day of_____20_____

BETWEEN

_____

[“the Employer”]

and

_____

[“the Contractor”]

APPENDICES

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Appendix 1. Terms and Procedures of Payment

APPENDIX 1. TERMS AND PROCEDURES OF PAYMENT

TERMS OF PAYMENT

(I) EPC Works

a) The Contractor shall be entitled to progress payments for the portions of the Contract Price for EPC Works upon presentation and approval of monthly Progress Certificates. Such certificates shall detail the Works for which payment is requested and shall be presented along with all required documents stated elsewhere in the Contract.

b) Progress Payments

The Contractor shall be entitled to receive the progress payments as per the schedules given below. The progress payments shall be released only on Signing of Contract agreement, furnishing Performance Security.

<table>
<tr><td></td><td colspan="3">Price Schedule No. 1: For Ex-works Supply of Plant & equipment including Specified spares, tools and instruments complete in all respect</td></tr>
<tr><td></td><td>Interest free Initial advance payment amounting to Fifteen (15) % of Price Schedule No. 1</td><td colspan="2">Payment may be made on submission of 2 nos. unconditional irrevocable Bank guarantees equivalent to 15% of cost of Supply items (i.e. Advance Payment BG-1 and BG-2 for 30% and 70% of advance amount respectively as per the format enclosed with the bid document).
The cumulative initial advance amount shall be recovered/adjusted within 14 months of date of issue of advance through Running Account Bill of Contractor as per schedule below:
<table>
<tr><th>Instalment No</th><th>Period from date of release of advance payment</th><th>Recovery Mechanism</th></tr>
<tr><td>1</td><td>0 to 9th Month</td><td>1. Recovery of the advance shall commence from the 1st RA Bill and shall be made pro-rata basis of advance released from the gross payment of all RA bills until such time as the advance payment has been paid. Always provided that the advance payment shall be completely repaid prior to the time when 80 percent of the price schedule 1 has been certified for payment.
2. In case, entire advance amount is recovered through RA Bills during the period of 9 months, BG-1 and BG-2 shall be released to contractor.
3. In case, entire advance amount is not recovered during the period of 9 months but same is greater than or equal to (> or =) 30% of total advance amount, BG-1 shall be released to contractor. In case of recovery more than 30% of advance, excess amount shall be adjusted from the RA bills during the period from 10-14 months.</td></tr>
</table></td></tr>
</table>

				4. In case, recovered advance amount is less than 30% of total advance amount during the period of 9 Months, BG-I shall be encashed. Balance amount of Advance after adjusting amount of BG-I and amount already recovered through RA bills till date, if any, shall be recovered during the period from 10-14 Months through RA Bills as per (1) above.	
			2	10th to 14th months	1. Recovery of the advance shall be made pro-rata basis of advance released from the gross payment of all RA bills as per the (1) above 2. In case, entire outstanding advance amount is recovered through RA Bills during the period of 10-14 months, BG-2 shall be released to contractor. 3. In case, entire outstanding advance amount is not recovered during the period, BG-2 shall be encashed and excess recovery, if any, shall be refunded to contractor.	

The validity of BG shall be up to 30 days beyond scheduled Completion period or extended period as per instruction of Engineer-in-Charge.

This advance shall not be released if more than 25% payment of Price Schedule No. 1 has already been released to the contractor.

Interest shall be charged at the rate of 2 years MCLR of SBI + 150 basis points above MCLR as applicable on the date of publication of NIT on delayed recoveries either due to the late submission of bill by the contractor or any other reason besides the reason giving rise to the encashment of BG.

For adjustment of advance, contractor shall be required to submit the respective bill to Engineer-in-charge at least 21 days before the last date of respective instalment recovery. In case contractor submit the bill after this due date and there is delayed recovery of advance, the period between last date of instalment recovery and actual date of adjustment of advance shall be considered for interest to be charged on account of delayed recovery. The recovery on this account to be made either from the RA Bills or from encashment of the BGs obtained from the Contractor for release of Advance. Contractor shall submit Utilization Certificate for the Initial Advance Taken along with the submission of RA Bills.

Note: In case above initial advance payment is not required/not availed by contractor, above 15% payment shall be paid alongwith the payment against dispatch of Material from Manufacturer's work. In such case, total payment against dispatch of material shall be 70% instead of 55% as per below mechanism.

	Against dispatch of Material from Manufacturer's work	55% (Fifty Five Percent) of Price Component of the Price Schedule No.1 (Cost of Supply Items) of each identified equipment shall be paid, Pro-rata basis along with 100% of GST, on dispatch of material from manufacturer's work on production of the following: a. Application of payment along with three (3) copies of GST Invoice. b. Material Dispatch Clearance Certificate (MDCC) issued by the Employer, wherever applicable as per relevant clause(s) of this Bid Document. c. Indemnity Bond as per bid document d. Copy of Storage & Erection All Risk Insurance Policy as per bid document only with the first Invoice.
	Upon receipt of Supply of Material/ Equipment at site & Acceptance thereof.	10% (Ten Percent) of Price Component of the Price Schedule No.1 (Cost of Supply Items) of each identified equipment shall be paid, Pro-rata basis along with 100% of GST, on receipt of material at Site on production of the following: a. Application of payment along with three (3) copies of GST Invoice. b. Physical Verification & discrepancy report by NHPC for the equipment/ material received and stored at site. Payment shall be released after making adjustment of discrepancies only.
	Upon completion of erection of each identified equipment upon Certificate of Engineer in Charge	2.5% (Two and Half Percent) of Price Component of the Price Schedule No.1 (Cost of Supply Items)
	Upon issuance of commissioning certificate of entire plant or part thereof, as allowed	2.5% (Two and Half Percent) of Price Component of the Price Schedule No.1 (Cost of Supply Items) on pro-rata basis
	Upon Final Acceptance of Entire Plant / On successful completion of Performance Guarantee	15% (Fifteen Percent) of Price Component of the Price Schedule No.1 (Cost of Supply Items) shall be paid on final acceptance of entire plant and issue of Operational Acceptance Certificate by the Employer.

II	**Price Schedule No. 2:** **"Providing all Services i.e. Port Handling, Insurance, Inland Transportation for delivery at Site, Site Storage & Handling, Installation, Testing, Commissioning and Integration with the Grid of Solar PV Plant including Power Evacuation system and all other Civil Works & Land Development including statutory approvals, permits, license etc. complete in all respect."**	
	Interest bearing advance payment amounting to ten (10%) of Price Schedule No. 2.	On submission of unconditional irrevocable Bank guarantee for 110 (One hundred ten) % of advance amount. The validity of BG shall be up to 30 days beyond scheduled completion period or extended period as per instruction of Engineer-in-Charge. This advance shall not be released if more than 25% payment of Price Schedule No. 2 has already been released to the contractor.
	On pro-rata basis against Completion and certification of Engineer- In-Charge for the quantum of work completed.	Eighty-Five Percent (85%) of the completed Installation Services component including Civil and allied Works included in Price Schedule No. 2 on certification of Engineer-In-Charge. The pro-rata advance and interest accrued thereon shall be recovered at this stage. However, the contractor can opt to settle off the balance contractual advance and interest accrued thereon against any invoice/ bill raised after making a formal request for the same to Engineer-in-Charge.
	Against successful completion of Performance and Guarantee tests, as specified, and issuance of Operational Acceptance Certificate by the Engineer-in-Charge.	Fifteen Percent (15%) of price component of the Contract Price of Price Schedule 2 shall be released on Commissioning of the Project on submission of unconditional irrevocable Bank Guarantee (in the format Approved by the Engineer-in- Charge) of equivalent amount valid up to 30 days beyond successful completion of Performance Guarantee tests, as specified, and issuance of Operational Acceptance Certificate by the Engineering- Charge. The Bank guarantee shall be released after successful completion and issuance of Operational Acceptance Certificate by the Engineer-in-charge.

III	**PRICE SCHEDULE NO. 3: COMPREHENSIVE OPERATION & MAINTENANCE CONTRACT**

	The Contractor shall be entitled to receive payments against the Price Schedule-3 for Comprehensive Operation and Maintenance (O&M) of the Solar PV Power Plant for 05 years from the date of commissioning including two years of defect liability period as given below: Payments during the O&M contract period shall be made on monthly basis, valuing to the monthly equated instalment of the price quoted in Price Schedule for 5 years O&M period, subject to any deduction and /or retention money. The employer will be billed by the contractor promptly on completion of each month during the O&M period. The monthly payment will be released against submission of all required documents stated elsewhere in the Contract not limited to the following: a) Application of payment for O&M Charges along with three (3) copies of GST Invoice. b) Certification of service acceptance by EIC. The Joint Meter Reading (JMR) / certified meter reading by DISCOM / Utility shall be submitted to employer (1st month JMR to be submitted with 2nd month bill of the contractor i.e. with 1 month lag time) for the previous month with the bill along with other supporting documents as required under the provisions of the O&M contract.

E-PAYMENT

PAYMENT PROCEDURES

The procedures to be followed in applying for certification and making payments shall be as follows:

1. Unless stipulated otherwise hereunder, all payments shall be released to the Contractor as per Schedule No. 1, 2, and 3 after fulfilment of the requirements specified herein above under Terms of Payment. The due date for payment shall be within 30 days of submitting invoices by the Contractor. In case of any disagreement between on any part of the Interim Payment, such part shall be severed from the rest and payment of such part shall be withheld and payment of balance admissible part shall be processed within specified 30 days. The clarification on disagreed part, if any, shall be sought by the Employer or his representative within 14 days of invoice submission and except in exceptional circumstances, these clarifications shall be sought in one go. The Contractor shall also be required to submit the clarification sought within next 14 days. After receipt of such clarifications / modifications furnished by Contractor and acceptance thereof by the Employer or his representative, payment in respect of such withheld items shall be processed within 15 days.

2. The Contractor should submit the consent in a mandate form for receipt of payment through EFT as per form attached herewith as Annex- X and provide the details of bank A/c in line with RBI guidelines for the same. These details will include bank name, branch name & address, A/c type, bank A/c no., bank and branch code as appearing on MICR cheque issued by bank. Further, Contractor should also submit certificate from their bank certifying the correctness of all above mentioned information in the mandate form. In case

of non-payment through EFT or where EFT facility is not available, payment will be released through cheque.

3. The rate of interest on delayed payment shall be simple interest 6% per annum yearly rest basis. The payment towards interest, if any, shall be settled at the time of making payments of the respective invoices. For calculation of duration of such delay, the period shall be reckoned after the stipulated time period as detailed at para 1.0 above.

4. The rate of interest on advance payment shall be 2 years MCLR of SBI + 150 basis points above MCLR as applicable on the date of publication of NIT. The date of Bill entry in MB will be treated as the date for calculation for interest on advance.

Annex-X

ECS FORM

ELECTRONIC CLEARING SERVICE (CREDIT CLEARING)
(PAYMENT TO PARTIES THROUGH CREDIT CLEARING MECHANISM)

No. : |_____|

1. BIDDER'S NAME : _____

Address : _____

_____

_____

Phone/Mobile No. : _____

2. PERTICULARS OF BANK ACCOUNT : _____

A. BANK NAME : _____

B. BRANCH NAME

Address : _____

Telephone No. : _____

C. IFSC code of the Bank : |_____|_____|_____|_____|_____|_____|_____|_____|_____|_____|_____|

(For payments through RTGS)

D. ACCOUNT TYPE : |_____|_____|

(S.B. Account/Current Account or Cash Credit with Code 10/11/13)

E. ACCOUNT NUMBER : _____

(As appearing on the Cheque Book)

I hereby declared that the particulars given above are correct and complete. If the transaction is delayed or not effected at all for reasons of incomplete or incorrect information, I would not hold the user Company responsible.

(…….)

Date: Signature of the Bidder

Certified that the particulars furnished above are correct as per our records.

(Bank's Stamp)

(…….)

Date: Signature of the Authorised Official from the Bank

Appendix 2. Price Adjustment

The total price for the entire scope of work (covered in the Bidding Documents) is on Firm Price Basis and the Prices shall remain Firm during entire period of Contract including 5 years of Comprehensive Operation and Maintenance Period.

******

Appendix 3. INSURANCE REQUIREMENTS

Insurances to be taken out by the Contractor

In accordance with the provisions of GCC Clause 34, the Contractor shall at its expense take out and maintain in effect, or cause to be taken out and maintained in effect, during the performance of the Contract, the insurances set forth below in the sums and with the deductibles and other conditions specified. The identity of the insurers and the form of the policies shall be subject to the approval of the Employer, such approval not to be unreasonably withheld.

(a) **Cargo Insurance**

Covering loss or damage occurring, while in transit from the Contractor's or Subcontractor's works or stores until arrival at the site including unloading, to the Plant and Equipment (including spare parts therefor) and to the Contractor's Equipment. This policy shall cover 'ALL RISKS' under and /or on deck as per Institute Cargo Clause 'A'.

Amount	Parties insured	From / To
Price of Schedule No. 1 of EPC Works	As per GCC Clause 34	From 1st shipment to last shipment.

(b) **Erection All Risks Insurance**

Covering physical loss or damage to the Facilities or part thereof at the site, occurring prior to completion of the Facilities, with extended maintenance coverage for the Contractor's liability in respect of any loss or damage occurring during the Defects liability period. The policy shall be extended to cover Work Stoppages clause and Intermittent Testing clause.

Amount	Deductible limits	Parties insured	From To
Price of Schedule No. 2, of EPC Works	As per TAC Norms	As per GCC clause 34	From commencement of work on Site to End of Defects Liability Period

(c) **Third Party Liability Insurance**

Covering bodily injury or death suffered by third parties (excluding the Employer's personnel) and loss of or damage to property (excluding the Employer's property and any parts of the Facilities that have been accepted by the Employer) occurring in connection with the supply and installation of the facilities.

Amount	Deductible limits	Parties insured	From To
INR 5.00 Crores per		As per GCC Clause	From Commencement of

occurrence and INR 20 Crores per year	INR 250,000	34	Work on site to End of Defects Liability period

(d) **Employer's Liability**

In accordance with the Public Liability Insurance Act applicable in the country where the Contract or any part thereof is executed.

The Employer shall be named as co-insured under all insurance policies taken out by the Contractor pursuant to GCC Sub-Clause 34.1, except for the Third Party Liability and Employer's Liability Insurances, and the Contractor's Subcontractors shall be named as co-insured under all insurance policies taken out by the Contractor pursuant to GCC Sub-Clause 34.1, except for the Cargo and Employer's Liability Insurances. All insurer's rights of subrogation against such co-insured for losses or claims arising out of the performance of the Contract shall be waived under such policies.

Note:

i) The losses below the deductible limit mentioned above, shall solely be the liability of the Contractor.

ii) If the contractor so desires, he may cover the risks under 'Cargo Insurance', Third Party liability & 'Erection All Risks Insurance' under one comprehensive policy.

iii) The Contractor shall take insurances for all risks except for risks mentioned as under:

(a) war, hostilities (whether war be declared or not), invasion act of foreign enemies.

(b) rebellion, revolution, insurrection, or military or usurped power, or civil war.

(c) ionizing radiations, or contamination by radio-activity from any nuclear fuel or from any nuclear waste from the combustion of nuclear fuel, radio-active toxic explosive or other hazardous properties of any explosive nuclear assembly or nuclear component thereof or(d) pressure waves caused by aircraft or other aerial devices traveling at sonic or supersonic speeds.

(iv) In case the Contractor has taken/takes blanket insurance policies for "Marine policy" during transportation of material and "Erection All Risk policy" during storage and erection, such polices shall also be acceptable to Employer provided that;

(a) The name of the Employer and the Project is endorsed in the said policies, and

(b) A clause be incorporated in the said policy that prior to settlement of any claim by the insurer against these policies, 'No objection certificate' shall be obtained from the Employer.

(v) Insurance of Power Plant during O&M stage shall be arranged by Employer at its own as per GCC clause 34.7

****

Appendix 4: Time Schedule

1.0 Time for Completion

a) Completion Period of **Setting up of 200 MW Solar PV Power Project in 600 MW in Solar park (Stage-1) of Gujarat State Electricity Corporation Ltd. (GSECL) at Khavda, Gujarat** is 15 (Fifteen) months reckoned from the date of issue of letter of award in terms of GCC clause 26.

b) Duration of Comprehensive Operation & Maintenance – 05 years from the date of commissioning including 24 months Defects liability period.

2.0 Submission with the Bid:

a) The Bidder shall furnish the detailed activity wise schedule on Project Management Tools like Primavera or Microsoft Project, considering the above completion period in Bar Chart Form alongwith the offer.

b) The Schedule shall cover all aspects like ordering, manufacturing and deliveryand construction.

Appendix 5. List of Approved Vendors
(As per Attachment 5)

Appendix 6. List of Documents for Approval or Review

Pursuant to GCC Sub-Clause 20.3.1, the Contractor shall prepare, and present to the Engineer in charge in accordance with the requirements of GCC Sub-Clause 18.2 for approval of Employer/Engineer in charge, the following documents for

A. **Approval**

1. Drawings / documents in respect of various equipment as per Technical Specifications.
2. QAP of Equipment / Materials as per Technical Specifications
3. Drawings of Equipment / Materials as per Technical Specifications
4. Detailed Data Sheet of Equipment/ Materials as per Technical Specifications.
5. Test Certificates of Equipment / Materials as per Technical Specifications.
6. The Credentials for selection of Sub – Contractors by Employer.
7. Any other document mutually agreed between Employer and Contractor within the Scope of Work.

B. Review / Information

1. Drawings/ documents in respect of various equipment as per as per Technical Specifications
2. Any other documents desired by the Employer /Engineer in charge within the Scope of Work.

Appendix 7. FUNCTIONAL GUARANTEES

1. GENERAL

This Appendix sets out

(a) the functional guarantees referred to in GCC Clause 28 (Functional Guarantees)
(b) the preconditions to the validity of the functional guarantees, either in production and/or consumption, set forth below
(c) the minimum level of the functional guarantees
(d) the formula for calculation of liquidated damages for failure to attain the functional guarantees.

2. PRECONDITIONS

The Contractor gives the functional guarantees (specified herein) for the facilities, subject to the following preconditions being fully satisfied:
[Conditions for carrying out of the Guarantee Test referred to in GCC Sub-Clause 25.2.]

3. FUNCTIONAL GUARANTEES

The minimum level of functional guarantees shall be as per Employer's requirement (Technical Specification - Clause no. 1.11 & 1.12 of General Technical Requirement (PTS-E&M))

4. FAILURE IN PERFORMANCE GUARANTEES AND LIQUIDATED DAMAGES

Subject to compliance with the Employer's requirement (Technical Specification - Clause no. 1.11 & 1.12 of General Technical Requirement (PTS-E&M)), this shall be regulated as per GCC Clause 28.

5. FAILURE IN GUARANTEES DURING O&M PERIOD

The calculation for shortfall in net exported energy shall be as per the Employer's requirement (Technical Specification) as per Clause 1.11 of Chapter 1 : General Technical Requirement of PTS – E&M works, and shall be regulated as per GCC Clause 28 under "Sub Clause-28.6".

****

Appendix 8: Anti Profiteering Certificate

(As per Attachment-10)

4a. FORM OF COMPLETION CERTIFICATE

Date: _____

[*Name of Contract]*

To: *[Name and address of Contractor]*

Dear Sir,

Pursuant to Clause 24 of the General Conditions of the Contract entered into between yourselves and the Employer 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 Employer 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]*

2. Date of Completion: *[date]*

However, you are required to complete the outstanding items listed in the attachment hereto as soon as practicable.

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
(Engineer in Charge)

4b . Form of Operational Acceptance Certificate

Date: _____
IFB No: _____

[Name of Contract]

To: *[Name and address of Contractor]*

Dear Sir,

Pursuant to GCC Sub-Clause 25.3 (Operational Acceptance) of the General Conditions of the Contract entered into between yourselves and the Employer dated *[date]*, relating to the *[brief description of the facilities]*, we hereby notify you that the Functional Guarantees of the following part(s) of the Facilities were satisfactorily attained on the date specified below.

1. Description of the Facilities or part thereof: *[description]*

2. Date of Operational Acceptance: *[date]*

This letter does not relieve you of your obligation to complete the execution of the Facilities in accordance with the Contract nor of your obligations during the Defects Liability Period.

Very truly yours,

Title
(Engineer In-Charge)

5a Performance Security Forms

(To be submitted by the Contractor)

Bank Guarantee Formate for Performance Security
(To be executed on Non-Judicial Stamp Paper of Appropriate value)

Bank Guarantee No.....
Date.....

To,
[Employer's Name & Address]

Dear Sirs,

In consideration of the ... [Employer's Name]..... (hereinafter referred to as the 'Employer' 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 Employer'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 Employer.

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 or meaning thereof, include its successors, administrators, executors and assigns) do hereby guarantee and undertake to pay the Employer, 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 Employer on the Bank shall be conclusive and binding notwithstanding any difference between the Employer 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 Employer and further agrees that the guarantees herein contained shall continue to be enforceable till the Employer discharges this guarantee or till ……(+)…….. [days/month/year] whichever is earlier.
(**)
The Employer 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 Employer 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 Employer and the Contractor or any other course or remedy or security available to the Employer. The Bank shall not be released of its obligations under these presents by any exercise by the Employer 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 Employer or any other indulgence shown by the Employer or by any other matter or thing whatsoever which under the law would, but for this provision have the effect of relieving the Bank.

The Bank declare that this Bank Guarantee is issued by the bank, utilizing the credit limit of M/s ---------- (Name of Contractor) also agrees that the Employer at its option shall be entitled to enforce this Guarantee against the Bank as a principal debtor, in the first instance without proceeding against the Contractor and notwithstanding any security or other guarantee the Employer may have in relation to the Contractor's liabilities.

i) Our liability under this Bank Guarantee shall not exceed _____(*)_____.

ii) This Bank Guarantee shall be valid upto _____(+)_____.

iii) We are liable to pay the guaranteed amount or any part thereof under this Bank Guarantee only and only if Employer serves upon Bank a written claim or demand on or before ----- (@)_____

Dated this .....day of ..... 20.....at.....

WITNESS

..... ……

(Signature) (Signature)

..... ……

(Name) (Name).

(Official Address) (Designation with Bank Stamp)/with staff Authority no.

Complete Address of the Bank with Tele-Fax

Notes :

1. (*) This sum shall be three percent (3%) of the accepted contract amount.

(@) This date will be

(i) For EPC portion Bank Guarantee- Six Months beyond the Defect Liability Period &

(ii) For O & M portion Bank Guarantee-Six months beyond the Completion of O&M Period as specified in the contract.

(+) This date will be
(i) For EPC portion Bank Guarantee-90 days beyond the Defect Liability Period &
(ii)For O &M portion Bank Guarantee-90 days beyond the date of Completion of O &M period as specified in the contract.

2. Bank Guarantee should be executed on appropriate stamp paper of requisite value; such stamp paper should be purchased in the name of Issuing Bank, not more than six (6) months prior to execution / issuance of Bank Guarantee. The name of the purchaser should appear at the back side of stamp paper in the Vendors Stamp. Bank guarantee should contain rubber stamp of the authorized signatory of the bankindicating the name, designation and signature/ power of attorney number as well as telephone/ fax numbers with full correspondence address of the Bank.

3. Bank Guarantee is required to be submitted directly to the Employer by the issuing bank (on behalf of Contractor) The Contractor can submit an advance copy of Bank Guarantee to the Engineer.

4. The issuing bank shall write the name of bank's controlling branch/ Head Office along with contact details like telephone/ fax and full correspondence address in order to get the confirmation of BG from that branch/ Head office, if so required.

5b Bank Guarantee Form for interest bearing Advance Payment

(To be executed on Non-Judicial Stamp Paper of Appropriate value)

Bank Guarantee No.....
Date.....

To,
[Employer's Name & Address]

Dear Sir,

In consideration of the [*Employer's Name]*..... (hereinafter referred to as the 'Employer', 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 Employer's Letter of Acceptance No. ..... dated ..... and the same having been acknowledged by the Contractor, resulting into a Contract bearing No. .....dated.....valued at..... ……for .....*[Name of Contract*] .....(hereinafter called the 'Contract') and the Employer having agreed to make an advance payment to the Contractor for performance of the above Contract amounting ..... (in words and figures) as an Advance against Bank Guarantee to be furnished by the Contractor.

We.....*[Name and address of the Bank]*..... having its Head Office at ..... (hereinafter referred to as the 'Bank', which expression shall, unless repugnant to the context or meaning thereof, include its successors, administrators, executors and assigns) do hereby guarantee and undertake to pay the Employer, immediately on demand any or, all monies payable by the Contractor to the extent of .....*[advance amount]*..... as aforesaid at any time upto .....(@)..... without any demur, reservation, contest, recourse or protest and/ or without any reference to the Contractor. Any such demand made by the Employer on the Bank shall be conclusive and binding notwithstanding any difference between the Employer and the Contractor or any dispute pending before any Court, Tribunal, Arbitrator or any other authority. We agree that the guarantee herein contained shall be irrevocable and shall continue to be enforceable till the Employer discharges this guarantee.

The Employer shall have the fullest liberty without affecting in any way the liability of the Bank under this guarantee, from time to time to vary the advance or to extend the time for performance of the Contract by the Contractor. The Employer 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 Employer and the Contractor or any other course or remedy or security available to the Employer. The Bank shall not be released of its

obligations under these presents by any exercise by the Employer 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 Employer or any other indulgence shown by the Employer 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 declares that this Bank Guarantee is issued by the Bank, utilizing the credit limit of M/s .....(name of contractor) and also agrees that the Employer at its option shall be entitled to enforce this Guarantee against the Bank as a principal debtor, in the first instance without proceeding against the Contractor and notwithstanding any security or other guarantee that the Employer may have in relation to the Contractor's liabilities.

Notwithstanding anything contained herein:

i) Our liability under this Bank Guarantee shall not exceed._____.
ii) This Bank Guarantee shall be valid upto _____.

iii) We are liable to pay the guaranteed amount or any part thereof under this Bank Guarantee only and only if Employer serve upon Bank a written claim or demand on or before (@)_____

Dated this .....day of ..... at ..... .

WITNESS

..... (Signature).....
(Signature)
.....
(Name) (Name).....

....
(Official Address)
(Designation with Bank Stamp)/Staff Authority No.
Dated.....

Notes: 1. (@) This date shall be thirty (30) days beyond the date of Completion of the Works.

2. Bank Guarantee should be executed on appropriate stamp paper of requisite value, such stamp paper should be purchased in the name of Issuing Bank, not more than six (6) months prior to execution / issuance of Bank Guarantee. The name of the purchaser should appear at the back side of stamp paper in the Vendors Stamp. Bank guarantee should contain rubber stamp of the authorized signatory of the bank indicating the name, designation and signature/ power of attorney number as well as telephone/ fax numbers with full correspondence address of the Bank.

In case the same is issued by a first class International Bank, the law prevalent in the country of execution shall prevail for the purpose of Stamp Duty on the Bank Guarantee. However, in such a case, the bank Guarantee shall be got confirmed through any Indian Scheduled/Nationalized Bank.

3. Bank Guarantee is required to be submitted directly to the Employer by the issuing bank (on behalf of Contractor)). The Contractor can submit an advance copy of Bank Guarantee to the Engineer.

4. The issuing bank shall write the name of bank's controlling branch/ Head Office along with contact details like telephone/ fax and full correspondence address in order to get the confirmation of BG from that branch/ Head office, if so required.

5c Deleted

5(d) PROFORMA FOR BANK GUARANTEE FOR ADVANCE PAYMENT

(Advance Payment BG-1)

(To be stamped in accordance with Stamp Act)

Bank Guarantee No ……...

Date ……...

To,

General Manager (Renewable Energy Division),

NHPC Office Complex,

Faridabad, Haryana- 121003,

Dear Sir,

In consideration of [*Insert Employer's Name*] (hereinafter referred to as the Employer', which expression shall, unless repugnant to the context or meaning thereof include its successors, administrators and assigns) having awarded to M/s [*Insert Contractor's Name*] with its Registered/Head Office at [*Insert address of Contractor's Registered Office*] (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 Employer's Letter of Award No. [*Insert Letter of Award No.*] dated [*Insert date of Letter of Award*] and the same having been unequivocally accepted by the Contractor, resulting into a Contract bearing No. [*Insert Contract Bearing No.*] dated [*Insert date of Contract*] valued at [*Insert Value of Contract]* for [*Insert Name of Contract*] (hereinafter called the 'Contract') and the Employer having agreed to make an advance payment to the Contractor for performance of the above Contract amounting [*Insert Amount of Advance as per Terms and Procedure for Payments' Clause no. I , in Figures]* ([*Insert Amount of Advance as per per Terms and Procedure for Payments' Clause no. I, in words]*) as an Advance against Bank Guarantee to be furnished by the Contractor.

We[*Insert name and address of the Bank*] having its Head Office at [*Insert registered Head Office address of the Bank*] (hereinafter referred to as the 'Bank', which expression shall, unless repugnant to the context or meaning thereof, include its successors, administrators, executors and assigns) do hereby guarantee and undertake to pay the Employer, immediately on demand any or, all monies payable by the Contractor to the extent of [*Insert a value equivalent to **30%** of advance amount as per Terms and Procedure for Payments' Clause no. I, in figures*] ([*Insert a value equivalent to **30%** advance amount as per per Terms and Procedure for Payments' Clause no. I , in words*] as aforesaid at any time upto including.....(@).....without any demur, reservation, contest, recourse or protest and/or without any reference to the Contractor. Any such demand made by the Employer on the Bank shall be conclusive and binding notwithstanding any difference between the Employer 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 Employer and further agrees that the guarantee herein contained shall be enforceable till thirty (30) days after expiry of its validity.

The Employer shall have the fullest liberty without affecting in any way the liability of the Bank under this guarantee, from time to time to vary the advance or to extend the time for performance of the Contract by the Contractor. The Employer 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 Employer and the Contractor or any other course or remedy or security available to the Employer. The Bank shall not be released of its obligations under these presents by any exercise by the Employer of its liberty with reference to the matters aforesaid or any of the more by reason of any other actor forbearance or other acts of omission or commission on the part of the Employer or any other indulgence shown by the Employer 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 declares that this Bank Guarantee is issued by the Bank utilizing the credit limit of M/s …….(name of contractor) and the Bank also agrees that the Employer at its option shall be entitled to enforce this Guarantee against the Bank as a principal debtor, in the first instance without proceeding against the Contractor and notwithstanding any security or other guarantee that the Employer may have in relation to the Contractor's liabilities.

Notwithstanding anything contained hereinabove our liability under this guarantee is limited to [*Insert a value equivalent to **30%** of advance amount*] and it shall remain in force upto and including .....(@).....and shall be extended from time to time for such period (not exceeding one year),as may be desired by M/s[*Contractor's Name*] on whose behalf this guarantee has been given.

Dated this..... day of .....20xx..... at.....

WITNESS

…….…… …… (Signature)

(Signature)

…….…… ……

(Name) (Name)

…….…… ……

(Official Address)

(Designation with Bank Stamp)

Power of Attorney No. …….

Date …….....

Note:

1. (@) This date shall be Thirty (30) days beyond the date of Completion of the last facility covered under the Contract.
2. Bank Guarantee should be executed on appropriate stamp paper of requisite value, such stamp paper should be purchased in the name of Issuing Bank, not more than six (6) months prior to execution / issuance of Bank Guarantee. The name of the purchaser should appear at the back side of stamp paper in the Vendors Stamp. Bank guarantee should contain rubber stamp of the authorized signatory of the bank indicating the name, designation and signature/ power of attorney number as well as telephone/ fax numbers with full correspondence address of the Bank.

   In case the same is issued by a first class International Bank, the law prevalent in the country of execution shall prevail for the purpose of Stamp Duty on the Bank Guarantee. However, in such a case, the bank Guarantee shall be got confirmed through any Indian Scheduled/Nationalized Bank.

3. Bank Guarantee is required to be submitted directly to the Employer by the issuing bank (on behalf of Contractor). The Contractor can submit an advance copy of Bank Guarantee to the Engineer.

4. The issuing bank shall write the name of bank's controlling branch/ Head Office along with contact details like telephone/ fax and full correspondence address in order to get the confirmation of BG from that branch/ Head office, if so required.

5(e) PROFORMA FOR BANK GUARANTEE FOR ADVANCE PAYMENT

(Advance Payment BG-2)

(To be stamped in accordance with Stamp Act)

Bank Guarantee No ……...

Date ……...

To,

General Manager (Renewable Energy Division),

NHPC Office Complex,

Faridabad, Haryana- 121003,

Dear Sir,

In consideration of [*Insert Employer's Name*] (hereinafter referred to as the Employer', which expression shall, unless repugnant to the context or meaning thereof include its successors, administrators and assigns) having awarded to M/s [*Insert Contractor's Name*] with its Registered/Head Office at [*Insert address of Contractor's Registered Office*] (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 Employer's Letter of Award No. [*Insert Letter of Award No.*] dated [*Insert date of Letter of Award*] and the same having been unequivocally accepted by the Contractor, resulting into a Contract bearing No. [*Insert Contract Bearing No.*] dated [*Insert date of Contract*] valued at [*Insert Value of Contract]* for [*Insert Name of Contract*] (hereinafter called the 'Contract') and the Employer having agreed to make an advance payment to the Contractor for performance of the above Contract amounting [*Insert Amount of Advance as per Terms and Procedure for Payments' Clause no. I , in Figures]* ([*Insert Amount of Advance as per per Terms and Procedure for Payments' Clause no. I, in words]*) as an Advance against Bank Guarantee to be furnished by the Contractor.

We[*Insert name and address of the Bank*] having its Head Office at [*Insert registered Head Office address of the Bank*] (hereinafter referred to as the 'Bank', which expression shall, unless repugnant to the context or meaning thereof, include its successors, administrators, executors and assigns) do hereby guarantee and undertake to pay the Employer, immediately on demand any or, all monies payable by the Contractor to the extent of [*Insert a value equivalent to **70%** of advance amount as per Terms and Procedure for Payments' Clause no. I, in figures*] ([*Insert a value equivalent to **70%** advance amount as per per Terms and Procedure for Payments' Clause no. I , in words*] as aforesaid at any time upto including.....(@).....without any demur, reservation, contest, recourse or protest and/or without any reference to the Contractor. Any such demand made by the Employer on the Bank shall be conclusive and binding notwithstanding any difference between the Employer 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 Employer and further agrees that the guarantee herein contained shall be enforceable till thirty (30) days after expiry of its validity.

The Employer shall have the fullest liberty without affecting in any way the liability of the Bank under this guarantee, from time to time to vary the advance or to extend the time for performance of the Contract by the Contractor. The Employer 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 Employer and the Contractor or any other course or remedy or security available to the Employer. The Bank shall not be released of its obligations under these presents by any exercise by the Employer of its liberty with reference to the matters aforesaid or any of the more by reason of any other actor forbearance or other acts of omission or commission on the part of the Employer or any other indulgence shown by the Employer 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 declares that this Bank Guarantee is issued by the Bank utilizing the credit limit of M/s……..(Name of the contractor) and the Bank also agrees that the Employer at its option shall be entitled to enforce this Guarantee against the Bank as a principal debtor, in the first instance without proceeding against the Contractor and notwithstanding any security or other guarantee that the Employer may have in relation to the Contractor's liabilities.

Notwithstanding anything contained hereinabove our liability under this guarantee is limited to [*Insert a value equivalent to **70%** of advance amount*] and it shall remain in force upto and including .....(@).....and shall be extended from time to time for such period (not exceeding one year),as may be desired by M/s[*Contractor's Name*] on whose behalf this guarantee has been given

Dated this..... day of .....20xx..... at.....

WITNESS

…….…… …… (Signature)

(Signature)

…….…… ……

(Name) (Name)

…….…… ……

(Official Address)

(Designation with Bank Stamp)

Power of Attorney No. …….

Date …….....

Note:

1. (@) This date shall be Thirty (30) days beyond the date of Completion of the last facility covered under the Contract.
2. Bank Guarantee should be executed on appropriate stamp paper of requisite value, such stamp paper should be purchased in the name of Issuing Bank, not more than six (6) months prior to execution / issuance of Bank Guarantee. The name of the purchaser should appear at the back side of stamp paper in the Vendors Stamp. Bank guarantee should contain rubber stamp of the authorized signatory of the bank indicating the name, designation and signature/ power of attorney number as well as telephone/ fax numbers with full correspondence address of the Bank.

   In case the same is issued by a first class International Bank, the law prevalent in the country of execution shall prevail for the purpose of Stamp Duty on the Bank Guarantee. However, in such a case, the bank Guarantee shall be got confirmed through any Indian Scheduled/Nationalized Bank.

3. Bank Guarantee is required to be submitted directly to the Employer by the issuing bank (on behalf of Contractor). The Contractor can submit an advance copy of Bank Guarantee to the Engineer.

4. The issuing bank shall write the name of bank's controlling branch/ Head Office along with contact details like telephone/ fax and full correspondence address in order to get the confirmation of BG from that branch/ Head office, if so required.

6. FORM OF TRUST RECEIPT FOR PLANT, EQUIPMENT AND MATERIALS RECEIVED

We M/s *(Contractor's Name)*..... having our Principal place of business at .....having been awarded a Contract No..... dated ..... for *(Contract Name)*..... by NHPC Ltd.

We do hereby acknowledge the receipt of the Plant, Equipment and Materials as are fully described and mentioned under Documents of Title/RR/LR etc. and in the schedule annexed hereto, which shall form an integral part of this receipt as "Trustee" of NHPC. The aforesaid materials etc. so received by us shall be exclusively used in the successful performance of the aforesaid Contract and for no other purpose whatsoever. We undertake not to create any charge, lien or encumbrance over the aforesaid materials etc., in favour of any other person/institution(s)/Banks.

For M/s .....
(Contractor's Name)

Dated : ..... (AUTHORISED SIGNATORY)

Place : ..... SEAL OF COMPANY

7a FORM OF INDEMNITY BOND TO BE EXECUTED BY THE CONTRACTOR FOR THE EQUIPMENT HANDED OVER IN INSTALMENTS BY THE EMPLOYER FOR PERFORMANCE OF ITS CONTRACT

(On Non-Judicial stamp paper of appropriate value)

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 NHPC Ltd., a Company incorporated under the Companies Act, 1956 having its Registered Office at Sector 33, Faridabad (India) and its project in the …… District in the State of ……. (India) respectively, (hereinafter called "NHPC") which expression shall include its successors and assigns):

WHEREAS NHPC has awarded to the Contractor a Contract for ..... vide its Notification of Award/Contract No.....dated ..... and its Amendment No. ..... (hereinafter called the Contract") in terms of which NHPC is required to hand over various Equipments 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 in NHPC for the Equipments handed over to it by NHPC for the purpose of performance of the Contract/Erection portion of the contract (hereinafter called the "Equipments")

NOW THEREFORE, this Indemnity Bond witnesseth as follows:

1. That in consideration of various Equipments as mentioned in the Contract, valued at *(Currency and amount in figures)..... (Currency and amount in words) ..... (Mention the value of the equipment)* to be handed over to the Contractor in installments from time to time for the purpose of performance of the Contract, the Contractor hereby undertakes to indemnify and shall keep NHPC indemnified, for the full value of the Equipments. The Contractor hereby acknowledges actual receipt of the initial installment of the Equipment etc. as per details in the Schedule appended hereto. Further, the Contractor agrees to acknowledge actual receipt of the subsequent installments of the Equipments etc. as required by NHPC in the form of Schedules consecutively numbered which shall be attached to this Indemnity Bond so as to form integral parts of this Bond. The Contractor shall hold such Equipments etc. in trust as a "Trustee" for and on behalf of NHPC.

2. That the Contractor is obliged and shall remain absolutely responsible for the safe transit/protection and custody of the Equipment at NHPC project site against all risks whatsoever till the Equipments are duly used/erected in accordance with the terms of the Contract and the plant/package duly erected and commissioned in accordance with the terms of the Contract, is taken over by NHPC. The Contractor undertakes to keep NHPC harmless against any loss or damage that may be caused to the Equipments.

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 utilized 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 NHPC is and shall remain the exclusive Employer of the Equipments free from all encumbrances, charges or liens of any kind, whatsoever. The Equipments shall at all times be open to inspection and checking by the Engineer in charge or other employees/agents authorized by him in this regard. Further, NHPC shall always be free at all times to take possession of the Equipments in whatever form the Equipments may be, if in its opinion, the equipments are likely to be endangered, mis-utilized 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 NHPC to return the Equipments without any demur or reservation.

5. That this Indemnity Bond is irrevocable. If at any time any loss or damage occurs to the Equipments or the same or any part thereof is mis-utilized in any manner whatsoever, then the Contractor hereby agrees that the decision of the Engineer-in-Charge of NHPC 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 Equipments at its own cost and/or shall pay the amount of loss to NHPC without any demur, reservation or protest. This is without prejudice to any other right or remedy that may be available to NHPC 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 NHPC, 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 authorized representative under the common seal of the Company, the day, month and year first above mentioned.

TABLE No.1

Particulars of Equipments handed over	**Quantity**	**Particulars of Dispatch title Documents**	**Carrier**	**Value of the Equipments**	**Signature of the Attorney in token of Receipt**
		RR/GR/Bill of loading No & Date			

(Please number subsequent schedules)

For and on behalf of

.....

(Contractor's Name)

WITNESS

1. Signature.....
Name.....
Address.....Designation of Authorizedrepresentative * (Common seal)
(In case of Company)

2. Signature.....
Name.....
Address.....Designation of Authorized representative * (Common seal)
(In case of Company)

* Indemnity Bond are to be executed by the authorized 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.

7b FORM OF INDEMNITY BOND TO BE EXECUTED BY THE CONTRACTOR FOR CUSTOM CLEARANCE AND RECONCILLIATION OF IMPORTS

(On Non-Judicial stamp paper of appropriate value)

INDEMNITY BOND

This INDEMNITY BOND is executed on this _____day of 20 , by (*Name of Contractor*), a Company incorporated under the laws of (*Name of country*) and having its Principal place of business at (*Address of the Contractor*) (hereinafter called as "Contractor", which expression shall include its successors and permitted assigns) in favour of NHPC Limited, a company incorporated under the Companies Act, 1956, having its registered office at NHPC Office Complex, Sector-33, Faridabad, Haryana-121003 (hereinafter called the "NHPC" which expression shall include its successor and assigns).

WHEREAS NHPC has entered into the following Contracts with the Contractor for execution of…….(Name of work)…….. (hereinafter called the "Contract"):

(Details of *Contract Nos. & Names to be incorporated*)

AND WHEREAS by virtue of Clause No. 21.3 of General Conditions of Contract of Contract Agreements, the Contractor has to perform all works necessary for clearance of all equipments from port authorities at Indian Port of disembarkation including port handling charges for Electro-mechanical equipment being imported by NHPC under Contract.

AND WHEREAS NHPC as an importer is required to register above Contract, in its name, for availing exemption from payment of customs duty under Section 98.01 of the Customs Tariff Act 1975 and by virtue of it being the importer, is responsible to customs authority for payment of customs duty, levies, damages etc.

NOW, THEREFORE, this Indemnity Bond witnessas follows:-

That in consideration of above, the Contractor undertakes to indemnify and keep NHPC indemnified against all omissions & commissions committed by the Contractor and losses, costs, expenses or damages suffered or incurred by NHPC by reason of Contractor's failure or default to pay port charges, levies, damages, penalties etc. to customs authority for the equipment imported by NHPC under the Contract. The Contractor shall further absolve NHPC of all liabilities and responsibilities in connection with processing the case for availing exemption of customs duty under Section 98.01 of the Customs Tariff Act 1975 (51 of 1975) and final reconciliation of all the imports with Customs Authorities within 3 months from the date of shipment of last consignment under Contract.

The Contractor also covenants that it shall at all times, on demand and without demur indemnify and also keep harmless NHPC against all losses, damages, claims and demands whatsoever which may be suffered by or brought or made against NHPC as a consequence of Contractor's failure to abide by or violating the terms and stipulations relating to the Contract Agreements or any provisions of Custom Tariff Act 1975 whatsoever.

That this Indemnity Bond is irrevocable.

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 NHPC then the above Bond shall be void, but otherwise it shall remain in full force and virtue. This Bond shall be returned to the Contractor after the customs authority discharges NHPC of the obligation under the Continuity Bond furnished by NHPC to the Customs Authority.

IN WITNESS WHEREOF the Contractor has hereunto set its hand through its authorized representative under the common seal of the Company, the day, month and year for above mentioned contract.
For and on behalf of *(Name of Contractor)*

Authorized Representatives **Common Seal**

Signature:
Name:
Designation:

Witness:

1. Signature _____
   Address _____
2. Signature / Name_____
   Address

* Indemnity Bond is to be executed by the authorized person having the Power of Attorney issued under common seal of the Company with authority to execute Indemnity Bonds. In case the Power of Attorney is specifically for this Contract then the original Power of Attorney should be attached to the Indemnity Bond or if it is a general Power of Attorney, a Photostat copy should be attached to the Indemnity Bond.

7c FORM OF HIGH SEAS SALE AGREEMENT

DATED: _____

This agreement of High Seas Sale is made and entered into at…….between M/s……(name of contractor) having its registered office ……. hereinafter referred to as the 'Seller' which expression unless repugnant to the context hereof shall mean and includes its successors, administrators and assigns of the FIRST PART AND NHPC Limited, a company registered under the Companies Act,1956, having its registered office at NHPC Office Complex, Sector-33, Faridabad, Haryana- 121003 hereinafter referred to as the 'Buyer' which expression unless repugnant to the context hereof shall mean and includes its successors, administrators and assigns of the SECOND PART.

Further, this agreement is made and entered into for import of Plant and Equipment under Contract Agreement No. ……. for ……. (name of Project) as per particulars given there under and schedule attached therewith.

MATERIAL	: As per Schedule attached herewith
QUANTITY	: As per Schedule attached herewith
MODE OF ARRIVAL	: BY SEA
B/L NO	: To be filled later
INVOICE NO	: To be filled later
IMPORT CODE NO (SELLER)	: .....
IMPORT CODE NO (BUYER)	: To be filled later
NAME OF FOREIGN SUPPLIER:	To be filled later
CONSIDERATION	: To be filled later

DELIVERY	ALL RIGHTS AND TITLES OF THE GOODS WILL BE TRANSFERRED IN FAVOUR OF THE BUYER BY THE ENDORSEMENT OF TRANSPORT DOCUMENT IN HIS FAVOUR.
PAYMENT	THE BUYER HAS TO MAKE THE PAYMENT ON DEMAND.
CLEARANCE	THE BUYER WILL ARRANGE FOR THE CLEARANCE OF THE GOODS AFTER MAKING PAYMENTS, CONSIDERATION, CLEARING CHARGES, DEMMURAGES AND CUSTOMS DUTY IF ANY, ON THEIR OWN.

TAXATION	THE SUBJECT SALES BEING ON HIGH SEAS IS EXEMPT FROM TAX.INCASE ANY TAX IS BEING IMPOSED BY ANY AUTHORITY WHATSOEVER IN FUTURE IT WILL BE ON A/C OF THE SELLER ONLY.
. INSURANCE	IN CASE THERE IS AN ISSUE WITH REGARD TO INSURANCE, THEN THE SAME SHALL BE DEALT AS PER GCC CLAUSE……..OF CONTRACT AGREEMENT NO…..…… REFFRED ABOVE.

THE ABOVE SALE IS ALSO SUBJECT TO FORCE MAJEURE CLAUSE AS CONTAINED IN GCC CLAUSE OF CONTRACT AGREEMENT NO. …….

IN WITNESS THEREOF SELLER AND THE BUYER HERETO HAVE SET THEIR RESPECTIVE HANDS AND SEALS ON THE DATE MENTIONED ABOVE.

SELLER SIGNATURE BUYER SIGNATURE

WITNESS:

1.
Name:……..
Address:,,,,,,,,,,,,,,,,,,,,
……

2.
Name:……
Address:……...
……

8 FORM OF AUTHORIZATION LETTER
NHPC LTD.

REF. NO. :
DATE :

To,

M/s *(Contractor's Name)*.....

Ref : Contract No.....……..Dated.....

for .....awarded by NHPC Ltd.

Dear Sirs,

Kindly refer to Contract No..... Dated ..... for ..... *(Contract Name)*. You are hereby authorized on behalf of NHPC Ltd. having its registered office at Sector 33, Faridabad-121003, India, and its Project Located in …… Districts in the States of …….. to take physical delivery of materials/equipments covered under dispatch Document / Consignment Note 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 Authority)

(Designation): .....

Date .....

ENCL : as above

---

*Mention LR/RR No.

TABLE OF MATERIAL/EQUIPMENT COVERED UNDER DESPATCH TITLE DOCUMENT (RR NO. / LR NO. .....)

Sl. No.	Contract Name	NOA No./ Contract Agreement No.	Description of Materials/ Equipments	Spec. No.	Qty.	Value

(SIGNATURE OF THE PROJECT AUTHORITY)

(DESIGNATION).....

(DATE).....

(ON THE LETTER HEAD OF NHPC)

9 STATEMENT OF PERFORMANCE

Ref:# Dated……

To: *[Name and address of Contractor]*

Ref: "**Engineering Procurement and Construction (EPC) Contract for _____(Name of Project)_____**

Sir,

I, the undersigned, representing NHPC Ltd. hereby issue Statement of Performance to entitle *[Name of Contractor]* to receive a sum of *(in figures) (in words)* in accordance with the payment terms stipulated in the Contract # *[Name of Contract & Contract No.]* Dated _____ between NHPC Ltd., and *[Name of Contractor]*

NHPC Ltd.

(Authorized Signatory)

10. FORM OF JOINT VENTURE/CONSORTIUM AGREEMENT

(To be executed on Non Judicial stamp paper of appropriate value)

This Joint Venture/Consortium Agreement made and entered into on this ---------- day of ----------, ----------.

BY AND BETWEEN

----------(Name of the Lead Partner) a Company incorporated 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 Partner" which expression unless otherwise repugnant hereto includes its successors, administrators, and permitted assigns thereof,** represented by **Mr. ---------- (Name of Authorized signatory(ies).**

AND

----------(Name of the other Partner)a Company incorporated 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 Partner-1 which expression unless otherwise repugnant hereto includes its successors, administrators, and permitted assigns thereof,**represented byMr. ---------- **(Name of Authorized signatory (ies).**

AND

----------(Name of the other Partner)a Company incorporated 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 Partner-2 which expression unless otherwise repugnant hereto includes its successors, administrators, and permitted assigns thereof,**represented byMr. ---------- **(Name of Authorized signatory (ies).**

All and/or each of them hereinafter referred to as "the Parties".

WITNESSETH

WHEREAS NHPC LIMITED (hereinafter referred to as "The Employer") has issued a Domestic Invitation vide NIT No. ---------- dated ----------

for the execution of **" Setting up of 200 MW Solar PV Power Project in 600 MW in Solar park (Stage-1) of Gujarat State Electricity Corporation Ltd. (GSECL) at Khavda, Gujarat.** The Employer intends to invite bids from eligible Bidders for Domestic Competitive Bidding (DCB) in respect of the above works.

WHEREAS the Parties are interested in jointly preparing and submitting a Bid to qualify, for the Project as a loose knit Joint venture/Consortium.

Article 1.0 PURPOSE OF THIS AGREEMENT

1.1 The purpose of this Agreement is to define the principles of collaboration among the Parties to:

**** Strike out which is not applicable.***

- Submit a Bid jointly to qualify for the execution of **"Setting up of 200 MW Solar PV Power Project in 600 MW in Solar park (Stage-1) of Gujarat State Electricity Corporation Ltd. (GSECL) at Khavda, Gujarat"** as a loose-knit Joint venture/Consortium.
- Prepare and submit technical and commercial proposals to the Employer, if invited by Employer.
- Negotiate and sign Contract in case of award.
- Provide and perform the Works in accordance with the Contract.

1.2 NAME

For the purpose of participating in the Bid, the name of the Consortium/Joint Venture shall be "_____".

Article 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 Employer for **"Setting up of 200 MW Solar PV Power Project in 600 MW in Solar park (Stage-1) of Gujarat State Electricity Corporation Ltd. (GSECL) at Khavda, Gujarat"** 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 Employer for the performance of the works in accordance with the terms and conditions of the Bid document and/or Contract.

Article 3.0 LEADERSHIP

---------- (Name of the Lead Partner) shall act as Leader of the Joint Venture/Consortium. As such, it shall act as the coordinator of the Party's combined activities and shall carry out the following functions:

3.1 To ensure the technical, commercial and administrative co-ordination of the Project.

3.2 To lead the contract negotiations of the Works with the Employer.

3.3 The Lead partner is authorized to receive instructions and incur liabilities for and on behalf of any or all Parties.

3.4 In case of an award, act as channel of communication between the Employer and the Parties to execute the Contract

3.5 Responsible for overall performance of the contract.

Article 4.0 SCOPE OF WORKS AND SERVICES OF EACH PARTY

The Scope of works to be performed by each Party shall be as herein below:

4.1 **Scope of Works and Services:**

The Scope of Work and services for each Party shall be defined as follows:

4.1.1 …… (**Name of Lead Partner**) shall be responsible for the following (Define the scope of works):-

-
-
-

4.1.2 …… (**Name of Partner-1**) shall be responsible for the following (Define the scope of works):-

-
-
-

4.1.3 …… (**Name of Partner-2**) shall be responsible for the following (Define the scope of works):-

-
-
-

Each partner of the Joint Venture/Consortium shall be responsible for execution of that item of work for which they claims to have specific construction experience.

4.2 Participation Share of each Partner

Lead Partner	……. %
Partner-1	……. %
Partner-2	……..%

4.3 Capital Contribution to be made by each Party for the Works

Lead Partner	……. %
Partner-1	……. %
Partner- 2	…….%

4.4 Financial Commitment of each Party in terms of Contract Value

Lead Partner	……. %
Partner-1	……. %
Partner-2	……..%

4.5 Sharing of Profit and Loss by each Party

Lead Partner	……. %
Partner-1	……. %
Partner-2	……%

The payments shall be made in the name of _____(Name of Joint Venture/ Consortium as appearing in Article 1.2 above).

OR

The payments shall be made in the name of each Party proportionate to the financial commitment of each Party as defined under Article 4.4 above.

(Strike out whichever is not applicable)

Article 5.0 SECURITIES

Securities in the form of Bank Guarantees, required under the Bid document and/or Contract shall be provided in the name of individual partner of Joint Venture/Consortium in proportion of its participation share. In case of foreign JV partner or foreign contractor, the Bank Guarantee shall be acceptable only if these are issued by Bank of International repute situated in home country of foreign JV partner/ contractor to be confirmed by an authorized Bank in India, as per guidelines of RBI.

Article 6.0 LIABILITY

6.1 **LIABILITY OF THE PARTIES WITH RESPECT TO CLAIMS OF THE EMPLOYER**

The Parties shall be jointly and severally liable to the Employer for the Performance of the work under the terms of the Contract.

6.2 In case there is dispute between the parties to the Joint Venture; the same shall not affect the work of the Employer.

Article 7.0 DURATION OF THE AGREEMENT

7.1 This Agreement is valid until end of Defect Notification Period of the Contract and full and final settlement of all accounts and disputes, if any, between the Parties and the Employer, except

a) if the Employer has decided previously not to award the Contract to the Parties, or
b) if one of the parties is declared bankrupt,

in which case the Parties are free from any obligation under this Agreement.

7.2 The Joint Venture Agreement shall not be terminated or modified by the parties without the written consent of the Employer.

IN WITNESS WHEREOF, this agreement executedon the _____day of _____ (month) 20____ by the duly authorized representatives of the parties hereto.

For and on behalf of M/s _____
(Lead Partner)
Name:

Seal:

For and on behalf of M/s _____
(Partner-1)
Name:

Seal:

For and on behalf of M/s _____
(Partner-2)
Name:

Seal:

NOTARY

* Joint Venture/Consortium Agreement (attested by Notary Public) and signed between the Partner(s) of JV/C as per above format shall be submitted alongwith the Bids of the Bidders.

11. (I) DELETED

11 (II) DELETED

12. (a) PROFORMA OF CERTIFICATE FROM THE CEO/CFO OF THE HOLDING COMPANY.

To
General Manager (Civil Contracts-III), NHPC Ltd.,
Room No.218, 2nd Floor, Jyoti Sadan,
NHPC OFFICE COMPLEX,
Sector-33, Faridabad-121003, Haryana, India
Tele No :+91 (129) 2270596

Subject: **Setting up of 200 MW Solar PV Power Project in 600 MW in Solar park (Stage-1) of Gujarat State Electricity Corporation Ltd. (GSECL) at Khavda, Gujarat.**
TENDER ID:

Dear Sirs,

1.0 I,Mr.....(CEO of the Company / CFO of the Company)* declare thatM/s..... (Name of the Holding Company) is the HoldingCompanyofM/s. ..... (Name of theBidder).

2.0 I hereby confirm and undertake that the unaudited unconsolidated financial statements submitted in respect of the bidder as part of the bid reference no. .....
dated .....have been considered for the purposes of the finalisation of Consolidated Financial Statements of the Holding Company as part of the Annual Reports.

3.0 I further, certify that the figures in the unaudited unconsolidated financial statements are true and correct and same have been duly reflected in the audited consolidated financial statements and / or Annual Report of the HoldingCompany.

Yours faithfully

(Signature)

Date : (Name &Designation).....

Place : (Name of the Holding Company) .....

(Seal of Holding Company)
.....

Note : *Strike off whichever is notapplicable.

12. (b) PROFORMA OF UNDERTAKING

(TO BE FURNISHED ON NON-JUDICIAL STAMP PAPER OF APPROPRIATE VALUE)

(To be executed by the Holding Company Supported by Board Resolution and submitted by the Bidder alongwith the Bid, Applicable to the Bidder for meeting the stipulated Financial Qualifying Requirement as per clause 3.2.B of Eligibility Criteria)

To
General Manager (Civil Contracts-III), NHPC Ltd.,
Room No.218, 2nd Floor, Jyoti Sadan,
NHPC OFFICE COMPLEX,
Sector-33, Faridabad-121003, Haryana, India
Tele No :+91 (129) 2270596

Subject: **Setting up of 200 MW Solar PV Power Project in 600 MW in Solar park (Stage-1) of Gujarat State Electricity Corporation Ltd. (GSECL) at Khavda, Gujarat**

Dear Sirs,

1.0 We, M/s..... declare that we are the holding company ofM/s ..... (Name of the Bidder) and have controlling interest therein.

M/s. .....(Name of the Bidder) proposes to submit the bid for Development of Solar Project having reference no.....dated .....and have sought financial strengthand support from us for meeting the stipulated Financial Qualifying Requirement as per Clause No. 3.2.B.1 of Eligibility requirement.

2.0 We hereby undertake that we hereby pledge our unconditional & irrevocable financial support for the execution of the said package to M/s. .....(Nameof the Bidder), in case they are awarded the Contract for the said package. We further agree that this undertaking shall be without prejudice to the various liabilities that M/s ..... (Name of Bidder) would be required to undertake in terms of the Contract including the Performance Security as well as other obligations of theBidder/Contractor.

3.0 This undertaking is irrevocable and unconditional, and shall remain in force till the successful execution and performance of the entire contract and/or till it is discharged by Employer.

4.0 We are herewith enclosing a copy of the Board Resolution in support of this undertaking.

Yours faithfully

(Signature of Authorised Signatory on behalf of the Holding Company)

Witness :

(1)..... (Name &Designation).....

(Name of the HoldingCompany).....

(2)..... (Seal of the HoldingCompany).....

Date:

Place:

12. (c) PROFORMA OF CERTIFICATE FROM THE CEO/CFO IN ACCORDANCE WITH ITEM CLAUSE 3.2.B OF ELIGIBILITY CRITERIA

To
General Manager (Civil Contracts-III), NHPC Ltd.,
Room No.218, 2nd Floor, Jyoti Sadan,
NHPC OFFICE COMPLEX,
Sector-33, Faridabad-121003, Haryana, India
Tele No :+91 (129) 2270596

Subject: **Setting up of 200 MW Solar PV Power Project in 600 MW in Solar park (Stage-1) of Gujarat State Electricity Corporation Ltd. (GSECL) at Khavda, Gujarat.**

Dear Sirs,

I, Mr. ..... (CEO/ CFO of the Company) of.....(Name of theCompany) Declare that the financial results of M/s. .....(Nameof theBidder)are under audit as on.....(Date of applications for bid) and the Certificate from the practicing
Chartered Accountant certifying the financial parameters is also not available.

Yours faithfully

(Signature)

Date : (Name &Designation).....

Place : (Name of the Company).....

(Seal of Company) .....

Note : *Strike off if not applicable.

12. (d) JOINT LETTER OF UNDERTAKING BETWEEN THE CEO OF THE HOLDING COMPANY / GROUP COMPANY OR SUBSIDIARY COMPANY & CEO OF THE BIDDER COMPANY IN ACCORDANCE WITH CLAUSE NO. 3.2.A OF ELIGIBILITY CRITERIA / QUALIFYING REQUIREMENTS.

(To be submitted by Bidder alongwith the bid)

To
General Manager (Civil Contracts-III), NHPC Ltd.,
Room No.218, 2nd Floor, Jyoti Sadan,
NHPC OFFICE COMPLEX,
Sector-33, Faridabad-121003, Haryana, India
Tele No :+91 (129) 2270596

Subject: "Setting up of 200 MW Solar PV Power Project in 600 MW in Solar park (Stage-1) of Gujarat State Electricity Corporation Ltd. (GSECL) at Khavda, Gujarat."

Dear Sirs,

I,Mr./Mrs .....(CEO of the Holding Company/Group Company)* declare thatM/s. ..... (Name of the Holding Company/Group Company)* is theHolding Company/Group Company* of M/s. ..... (Name of the Bidder Company) I hereby confirm that we meet qualifying requirement specified at **Clause 3.2.A.1* / 3.2.A.2 * / 3.2.A.3 of Eligibility Requirement** prior to the last date of submission of bid. Furthermore, I confirm to extend full support for complete performance of the contract in case of award .

OR

I, Mr./Mrs ..... (CEO of the Subsidiary Company)* declare that M/s.....(Name of theS ubsidiary company) is the Subsidiary Company of M/s. ..... (Name of the Bidding Company) I hereby confirm that we meet qualifying requirement specified at **Clause 3.2.A.1* / 3.2.A.2 */ 3.2.A.3*of Eligibility Requirement** prior to the last date of submission of application for enlistment. Further more, I confirm to extend full support for complete performance of the contract in case of award.

1.0

Yours faithfully (Signature)	Yours faithfully (Signature)
(Name& Designation).....	(Name& Designation).....
(Name of the Subsidiary Company)	(Name of the Holding Company/Group Company)
(Seal of Subsidiary Company)	(Seal of Holding Company)

Date:
Place:
Strike off whichever is not applicable.

FORM-14

UNDERTAKING FROM PARENT/ HOLDING COMPANY

(On the letter head of Parent/Holding Company)

No: …… Date:……..

Name & address of the Employer

Sub: " Setting up of 200 MW Solar PV Power Project in 600 MW in Solar park (Stage-1) of Gujarat State Electricity Corporation Ltd. (GSECL) at Khavda, Gujarat"

Tender ID:

Dear Sirs,

We, M/s…….. (Name of the Parent/Holding Company) having registered office at ……(Address of the Parent/Holding Company) do hereby undertake that in case work ……..(Name of work) is awarded to M/s …….. (Name of the Bidder) who is participating in your subject Tender as a Sole Bidder/ Consortium in JV, which is our subsidiary company, we on our strength/ strength (name of group company (ies)) under our control shall provide the full support for technical and financial requirements for the work "……." (the scope of work of subsidiary company) and we shall be responsible for the successful completion of the scope of works of M/s…… (Name of the Bidder subsidiary company).

In case the Bidder, M/s ……(Name of Subsidiary company) gets qualified and awarded the work, We do hereby undertake:

i) to enter into a separate agreement with the Employer as per the Employer's approved format included in the Bid documents.

We do hereby also confirm that we are not participating either as a sole Bidder or in another way against the above Invitation for Bids.

Yours faithfully,

For & on behalf of M/s. ……..
(Name & Address of the Parent/Holding Company)

(Office Seal)

Station:
Date:

Note: *1. This Letter of undertaking should be on the letterhead of the Parent/Holding Company and should be signed by a person competent and having the Power of Attorney to bind the Parent/Holding Company. Power of Attorney in favour of this person to do so together with the authority of its executant be enclosed with this Letter of Undertaking.*

2. In line with ITB clause if bidder is qualifying on the strength of Subsidiary company / Group Company under the same Apex/Parent company, then a commitment/ undertaking from such Subsidiary / Group Company for assured support and unhindered access to its assets and resources to the Bidder is also required to be submitted. This Letter of undertaking should be on

the letterhead of the Subsidiary company/ Group Company and should be signed by a person competent and having the Power of Attorney to bind the Subsidiary company/ Group Company. Power of Attorney in favour of this person to do so together with the authority of its executant be enclosed with this Letter of Undertaking

FORM – 15

PARENT/ HOLDING COMPANY AGREEMENT

THIS AGREEMENT IS MADE on this the…… th day of …… between the NHPC, a company incorporated under the laws of India and having its Registered Office at Faridabad India (hereinafter referred to as the 'Employer' which expression shall unless repugnant to the subject or context or meaning thereof include its successors, administrators, executors and assigns) of the one part; and …….(name of Parent/Holding Company) a company organized and existing under the laws of…… and having its Principal Office at ……. (Hereinafter referred to as the "Parent/Holding Company" which expression shall unless repugnant to the subject or context or meaning thereof include its respective successors, administrators, executors and assigns) of the other part;

WHEREAS on the Parent/Holding Company's commitment to provide full support for technical and financial requirements and be responsible and liable for successful completion of the works being awarded to M/s…….. (name of Subsidiary Company) and further agreeing to enter into a separate agreement with the Employer, the Employer has entered into a Contract with M/s ……..on …….(hereinafter referred to as the "Contractor" which expression shall unless repugnant to the subject or context or meaning thereof include its successors, administrators, executors and permitted assigns) for the execution of …… (name of work package) for NHPC Limited in the state of Haryana , India (hereinafter referred to as the "Contract").

And whereas, in consideration of the aforesaid commitment, the Parent/Holding Company hereby enters into this agreement with the Employer for providing full support for technical and financial requirements to the Contractor and be responsible and liable for successful performance and completion of the works described in the said Contract on the following terms and conditions:

NOW THEREFORE THE PARTIES HERETO HEREBY AGREE AND THIS AGREEMENT WITNESSETH AS FOLLOWS:

1. In this Agreement except where the context otherwise requires, the following expressions shall have the meaning hereinafter respectively assigned to them:

2. "Contract" shall mean the Contract dated …… entered into between the Employer and the Contractor for the execution of the Work described as above.

3.(a) The Parent/Holding Company hereby agrees to the Employer to ensure due and faithful performance of the obligations and liabilities by the Contractor under the Contract and remain responsible to irrevocably and unconditionally provide full technical and financial support to the Contractor for completion of the works covered under the Contract. The provisions of Contract shall mutatis-mutandis apply to the Parent/Holding Company.

3. (b) In the event of breach and/ or failure on the part of the Contractor to perform or fulfill any of its obligations and liabilities under the Contract, the Employer may at its discretion call upon the Parent/Holding Company and the Parent/Holding Company shall be obliged to execute and perform or cause to be executed and performed and to satisfy the obligations and liabilities of

the Contractor under the Contract in accordance with the terms and conditions thereof without prejudice to any other right or remedy, besides encashing the Bank guarantee(s).

3(c) The Parent/Holding Company shall indemnify and keep indemnified and harmless the Employer at all times against any loss, damage, cost charge and expense whatsoever that may be suffered or incurred by or caused to the Employer on account of such breach.

3(d) It shall not be necessary for the Employer to proceed against the Contractor before proceeding against the Parent/Holding Company and the Parent/Holding Company shall be liable to fulfill its obligations and liabilities hereunder notwithstanding the Employer having undertaken any proceedings and/or obtaining any security from the Contractor for the performance of its obligations under the Contract. In order to give affect to this Agreement, the Employer may at its option be entitled to act as if the Parent/Holding Company was the Contractor for successful completion of the works.

In the event, qualification of the Bidder/ Subsidiary Company is considered on the credentials of another Subsidiary/ Group Company under the same apex 'Parent Company' and due to any reason whatsoever, 'Parent Company' or any other group company wants to divest its investment in the direct or indirect subsidiary(ies) as a result of which any of these companies may not remain subsidiary(ies) of the 'Parent Company' then the 'parent Company' undertakes to ensure the performance of the works by arranging the required inputs in case of failure of Applicant subsidiary Company.

3(e) However, where the Bidder disputes the occurrence of a breach under the Contract and if such dispute is referred to Settlement of Disputes under General Conditions for the Contract Clause 6.0, the Contractor is obliged to carry on the works under the Contract. In case, during the pendency of the dispute in arbitration, the Contractor does not carry on the work satisfactorily, the Employer by notice to the Parent/Holding Company shall be entitled to invoke this Agreement, as if a breach had occurred for the purpose of Clause 3(b) hereinabove.

4. It is agreed that the obligations undertaken by the Parent/Holding Company hereunder shall be performed by it notwithstanding any difference or dispute between the Employer and the Contractor pending before any court, tribunal, arbitration or any other authority or forum.

5. This Agreement shall come into force and effect upon the Commencement Date of the Contract and shall remain in force and effective till the date of expiry of the Defects Liability Period by the Employer pursuant to the Conditions for the Contract.

6. This guarantee is in addition to and without prejudice to the securities offered by and on behalf of Contractor to the Employer and all rights and remedies in respect thereof be reserved. This guarantee shall be a continuing guarantee and be in force notwithstanding discharge of Contractor by operation of any law or insolvency/ bankruptcy / winding up/dissolution of the Contractor.

7. The Employer shall have the full liberty from time to time to vary any of the terms and conditions of the Contract by mutual agreement between the Employer and the Contractor and to extend time for performance thereunder by the Contractor or any other party thereto in accordance with the terms of the Contract and / or to postpone for any time and from time to time any of the powers exercisable by the Employer against the Contractor and either to enforce or forebear from enforcing any of the terms and conditions of the Contract and/or the securities available to the Employer from the Contractor and the Parent/Holding Company shall not be released from its obligations and liabilities under this Agreement in any manner

whatsoever by any exercise by the Employer of the liberty and / or the rights with reference to the matters as aforesaid or by reason of time being given to the Contractor or any other act of forbearance, waiver or omission on the part of Employer or any indulgence by the Employer to the Contractor or of any other matter or thing whatsoever which under the law relating to sureties would but for this provision have the effect of releasing the Parent/ Holding Company from its obligations and liabilities hereunder.

8. Nothing contained in this Agreement shall be construed or interpreted in any way as modifying or amending or relieving in any manner whatsoever the Contractor from their obligations under the Contract.

9. This Agreement shall be interpreted and be governed under the Law of India.

10. Any dispute or difference which may arise between the parties out of or in connection with this Agreement and which the Parties are unable to settle amicably shall be settled by reference to arbitration as per General/ Particular / Special Conditions of Contract. The venue of arbitration shall be New Delhi, India and the arbitration shall be conducted in accordance with the provisions of Arbitration and Conciliation Act 1996. The courts of Faridabad/Chandigarh shall have exclusive jurisdiction provided however that any award made in such arbitration shall be enforceable in any court of competent jurisdiction.

IN WITNESS WHEREOF THE PARTIES HERETO HAVE PUT THEIR HANDS HEREUNTO ON THE…… DAY ……. MONTH AND ……YEAR FIRST ABOVE WRITTEN AT FARIDABAD.

For and on behalf of the Employer (through authorized representative)	For and on behalf of the Parent/ Holding Company (through duly authorized representative)
Witnesses: 1 2.	Witnesses:

FORM – 16

PARENT/ HOLDING COMPANY AGREEMENT
(In case of Joint Venture/Consortium)

THIS AGREEMENT IS MADE on this the…… th day of …… between the NHPC Limited, a company incorporated under the laws of India and having its Principal Office at Sector 33, Faridabad, Haryana, India (hereinafter referred to as the 'Employer' which expression shall unless repugnant to the subject or context or meaning thereof include its successors, administrators, executors and assigns) of the one part; and …….(name of Parent/Holding Company) a company organized and existing under the laws of…… and having its Principal Office at ……. (Hereinafter referred to as the "Parent/Holding Company" of the Joint Venture Partner M/s ……which expression shall unless repugnant to the subject or context or meaning thereof include its respective successors, administrators, executors and assigns) of the other part;

WHEREAS on the Parent/Holding Company's commitment to provide full support for technical and financial requirements and be responsible and liable for successful completion of the scope of works of M/s …….(name of Subsidiary Company) being awarded to Joint Venture of M/s…….. (name of Joint Venture) and further agreeing to enter into a separate agreement with the Employer for the work of M/s …… of Joint Venture, the Employer has entered into a Contract with the Joint Venture comprising M/s …… and M/s ……..on …….(hereinafter referred to as the "Contractor" which expression shall unless repugnant to the subject or context or meaning thereof include their successors, administrators, executors and permitted assigns) for the execution of …… (name of work package) for …..….. Project in the State of ……..., India (hereinafter referred to as the "Contract").

And whereas, in consideration of the aforesaid commitment, the Parent/Holding Company hereby enters into this agreement with the Employer for providing full support for technical and financial requirements to its Subsidiary M/s …… and be responsible and liable for successful performance and completion of the woks described in the said Contract on the following terms and conditions:

NOW THEREFORE THE PARTIES HERETO HEREBY AGREE AND THIS AGREEMENT WITNESSETH AS FOLLOWS:

1. In this Agreement except where the context otherwise requires, the following expressions shall have the meaning hereinafter respectively assigned to them:

2. "Contract" shall mean the Contract dated …… entered into between the Employer and the Contractor for the execution of the Work described therein of the ……. Solar Project in the State of ……. in India.

3.(a) The Parent/Holding Company hereby agrees to the Employer to ensure due and faithful performance of the obligations and liabilities by M/s …… (name of Subsidiary Company) under his scope of the Contract and remain responsible to irrevocably and unconditionally provide full technical and financial support to M/s …… (name of Subsidiary Company) for completion of the works covered under the Contract. The provisions of Contract shall mutatis-mutandis apply to the Parent/Holding Company.

3. (b) In the event of breach and/ or failure on the part of M/s …… (name of Subsidiary Company) to perform or fulfill any of its obligations and liabilities under the Contract, the Employer may at its discretion call upon the Parent/Holding Company and the Parent/Holding Company shall be obliged to execute and perform or cause to be executed and performed and to satisfy the obligations and liabilities of the contractor under the Contract in accordance with the terms and conditions thereof without prejudice to any other right or remedy, besides encashing the Bank guarantee(s).

3(c) The Parent/Holding Company shall indemnify and keep indemnified and harmless the Employer at all times against any loss, damage, cost charge and expense whatsoever that may be suffered or incurred by or caused to the Employer on account of such breach.

3(d) It shall not be necessary for the Employer to proceed against the Contractor before proceeding against the Parent/Holding Company and the Parent/Holding Company shall be liable to fulfill its obligations and liabilities hereunder notwithstanding the Employer having undertaken any proceedings and/or obtaining any security from the Contractor for the performance of its obligations under the Contract. In order to give affect to this Agreement, the Employer may at its option be entitled to act as if the Parent/Holding Company was the Contractor for successful completion of the works.

In the event, qualification of the Bidder/ Subsidiary Company is considered on the credentials of another Subsidiary/ Group Company under the same apex 'Parent Company' and due to any reason whatsoever, 'Parent Company' or any other group company wants to divest its investment in the direct or indirect subsidiary(ies) as a result of which any of these companies may not remain subsidiary(ies) of the 'Parent Company' then the 'parent Company' undertakes to ensure the performance of the works by arranging the required inputs in case of failure of Applicant subsidiary Company.

3(e) However, where the Contractor disputes the occurrence of a breach under the Contract and if such dispute is referred to Settlement of Disputes of General Conditions for the Contract clause 6.0 , the Contractor is obliged to carry on the works under the Contract. In case, during the pendency of the dispute in arbitration, the Contractor does not carry on the work satisfactorily, the Employer by notice to the Parent/Holding Company shall be entitled to invoke this Agreement, as if a breach had occurred for the purpose of Clause 3(b) hereinabove.

4. It is agreed that the obligations undertaken by the Parent/Holding Company hereunder shall be performed by it notwithstanding any difference or dispute between the Employer and the Contractor pending before any court, tribunal, arbitration or any other authority or forum.

5. This Agreement shall come into force and effect upon the Commencement Date of the Contract and shall remain in force and effective till the date of expiry of the Defects Liability Period by the Employer pursuant to the Conditions for the Contract.

6. This guarantee is in addition to and without prejudice to the securities offered by and on behalf of Contractor to the Employer and all rights and remedies in respect thereof be reserved. This guarantee shall be a continuing guarantee and be in force notwithstanding discharge of Contractor by operation of any law or insolvency /bankruptcy /winding up/dissolution of the Contractor.

7. The Employer shall have the full liberty from time to time to vary any of the terms and conditions of the Contract by mutual agreement between the Employer and the Contractor and to extend time for performance thereunder by the Contractor or any other party thereto in accordance with the terms of the Contract and / or to postpone for any time and from time to time any of the powers exercisable by

the Employer against the Contractor and either to enforce or forebear from enforcing any of the terms and conditions of the Contract and/or the securities available to the Employer from the Contractor and the Parent/Holding Company shall not be released from its obligations and liabilities under this Agreement in any manner whatsoever by any exercise by the Employer of the liberty and / or the rights with reference to the matters as aforesaid or by reason of time being given to the Contractor or any other act of forbearance, waiver or omission on the part of Employer or any indulgence by the Employer to the Contractor or of any other matter or thing whatsoever which under the law relating to sureties would but for this provision have the effect of releasing the Parent/ Holding Company from its obligations and liabilities hereunder.

8. Nothing contained in this Agreement shall be construed or interpreted in any way as modifying or amending or relieving in any manner whatsoever the contractor from their obligations under the Contract.

9. This Agreement shall be interpreted and be governed under the Law of India.

10. Any dispute or difference which may arise between the parties out of or in connection with this Agreement and which the Parties are unable to settle amicably shall be settled by reference to arbitration as per General/Particular/Special Conditions of Contract. The venue of arbitration shall be New Delhi, India and the arbitration shall be conducted in accordance with the provisions of Arbitration and Conciliation Act 1996 and its amendments, if any. The courts of Faridabad/Chandigarh shall have exclusive jurisdiction provided however that any award made in such arbitration shall be enforceable in any court of competent jurisdiction.

IN WITNESS WHEREOF THE PARTIES HERETO HAVE PUT THEIR HANDS HEREUNTO ON THE…… DAY ……. MONTH AND ……YEAR FIRST ABOVE WRITTEN AT FARIDABAD.

For and on behalf of the Employer	For and on behalf of the Parent/ Holding Company
(through authorized representative)	(through duly authorized representative)

Witnesses:	Witnesses:
1	
2.	

FORM-17

Deleted

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