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(A Government of India Enterprise)
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Tender

For

**The Design, Engineering, Supply, Construction, Erection,
Testing & Commissioning of 5 MW (AC) grid connected
ground based Solar PV Power Plant along with 10 years
Plant O&M**

At

**V.O. Chidambaranar Port Trust (VOCPT), Tuticorin,
Tamilnadu, India**

Tender No. [SECI/C&P/PMC/11/0001/2021-22](#)

Dated: 27/12/2021

5 MW (AC) SPV Project	<u>Tender No</u> <u>SECI/C&P/PMC/11/0001/2021-22</u>	<u>COVER PAGE</u> <u>Page 1 of 3</u>	<u>Signature of Bidder</u>
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DISCLAIMER

1. Though adequate care has been taken while preparing the tender document, the bidder(s) shall satisfy themselves that the document is complete in all respect. Intimation regarding any discrepancy shall be given to the office of Employer immediately. If no intimation is received from any bidder within **10 (Ten) days from the date of issuance of Tender documents**, it shall be considered that the document is complete in all respect and has been received/ acknowledged by the bidder(s).
2. Solar Energy Corporation of India Ltd (SECI) reserves the right to modify, amend or supplement this document.
3. While this tender document has been prepared in good faith, neither SECI nor their employees or advisors make any representation or warranty, express or implied, or accept any responsibility or liability, whatsoever, in respect of any statements or omissions herein, or the accuracy, completeness or reliability of information, and shall incur no liability under any law, statute, rules or regulations as to the accuracy, reliability or completeness of this document, even if any loss or damage is caused by any act or omission on their part.
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Place: New Delhi

Date: 27/12/2021

5 MW (AC) SPV Project	<u>Tender No</u> <u>SECI/C&P/PMC/11/0001/2021-22</u>	<u>COVER PAGE</u> <u>Page 3 of 3</u>	<u>Signature of Bidder</u>
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SECTION - I

INVITATION

FOR BIDS (IFB)

5 MW (AC) SPV Project

Tender No
SECI/C&P/PMC/11/0001/2021-22

IFB
Page 1 of 10

Signature of Bidder

**INVITATION FOR BIDS (IFB)
FOR
DESIGN, ENGINEERING, SUPPLY, CONSTRUCTION, ERECTION, TESTING & COMMISSIONING
OF 5 MW (AC) GRID CONNECTED GROUND BASED SOLAR PV POWER PLANT HAVING 10
YEARS PLANT O&M**

AT

V.O. CHIDAMBARANAR, TUTICORIN, TAMILNADU, INDIA

(SINGLE STAGE TWO ENVELOPE BIDDING FOLLOWED BY E-REVERSE AUCTION)

REGARDING BCD:

MINISTRY OF NEW & RENEWABLE ENERGY VIDE OM NO 283/3/2018-GRID SOLAR DATED 09.03.2021 HAS NOTIFIED THE IMPOSITION OF BASIC CUSTOMS DUTY (BCD) ON SOLAR PV MODULES & CELLS WITH EFFECT FROM 01.04.2022. POST THIS DATE SOLAR MODULES WILL ATTRACT BCD @ 40% & SOLAR CELLS WILL ATTRACT BCD @ 25%. BIDDER'S ARE REQUIRED TO TAKE NOTE OF THIS TRAJECTORY & BID ACCORDINGLY, AS THE IMPOSITION OF BCD AS PER THIS MENTIONED TRAJECTORY WILL NOT BE CONSIDERED UNDER CHANGE IN LAW.

REGARDING PPP:

WRT MINISTRY OF NEW & RENEWABLE ENERGY (MNRE) ORDER NO 283/22/2019-GRID SOLAR DATED 23RD SEP 2020 FOR THE PUBLIC PROCUREMENT (PREFERENCE TO MAKE IN INDIA) INCLUDING ANY AMENDMENTS, TO PROVIDE FOR PURCHASE PREFERENCE (LINKED WITH LOCAL CONTENT) IN RESPECT OF RENEWABLE ENERGY (RE) SECTOR & DEPARTMENT FOR PROMOTION OF INDUSTRY AND INTERNAL TRADE (DPIIT) NOTIFICATION NO. P-45021/2/2017-PP (BE-LI) DATED 4TH JUNE, 2020 INCLUDING ANY AMENDMENTS,

THE PROCUREMENT OF SOLAR MODULES & SOLAR INVERTERS FOR THE SUBJECT TENDER WILL BE DONE FROM CLASS I LOCAL SUPPLIERS ONLY, WHEREIN, A CLASS-I LOCAL SUPPLIER' MEANS A SUPPLIER OR SERVICE PROVIDER, WHOSE GOODS, SERVICES OR WORKS OFFERED FOR PROCUREMENT, HAS LOCAL CONTENT EQUAL TO OR MORE THAN 50%, AS DEFINED UNDER THE ABOVE SAID ORDERS.

REGARDING ALMM:

THE PROVISIONS AS CONTAINED IN THE O.M. DATED 10.03.2021 ISSUED BY MNRE ON THE SUBJECT "APPROVED MODELS AND MANUFACTURERS OF SOLAR PHOTOVOLTAIC MODULES (REQUIREMENT OF COMPULSORY REGISTRATION) ORDER, 2019-IMPLEMENTATION-REG." AND ITS SUBSEQUENT AMENDMENTS AND CLARIFICATIONS, SHALL BE APPLICABLE FOR THIS TENDER. THE CELLS AND MODULES USED IN THE PROJECT UNDER THIS TENDER SHALL BE SOURCED ONLY FROM THE MODELS AND MANUFACTURERS INCLUDED IN THE LIST-I (SOLAR PV MODULES) OF ALMM ORDER, ANNEXURE-I OF THE OM, ISSUED BY MNRE ON 10TH MARCH, 2021 WHICH WILL BE

UPDATED BY MNRE FROM TIME TO TIME. THE MODULES TO BE PROCURED FOR THIS PROJECT, SHALL BE FROM THE LIST-I OF THE ALMM ORDER APPLICABLE ON THE DATE OF

INVOICING OF SUCH MODULES. BIDDERS SHALL ALSO PROVIDE A DISCLOSURE REGARDING THAT THEY ARE AWARE OF BINDING PROVISIONS OF THE ALMM ORDER AND THE LIST(S) THEREUNDER, WHILE QUOTING FOR THE TENDER.

- 1.0 V. O. Chidambaranar Port Trust (formerly Tuticorin Port Trust) is one of the 13 major ports in India. It was declared to be a major port on 11 July 1974. It is second-largest port in Tamil Nadu and fourth-largest container terminal in India. This is the third international port in Tamil Nadu and its second all-weather port. V. O. Chidambaranar Port Trust Thoothukudi is an ISO 9001:2008, ISO 14001:2004 and ISPS compliant Port.
- 2.0 V. O. Chidambaranar Port Trust (VOCPT), envisages the execution of Green Energy by way of implementing Solar PV Power Plant at VOCPT in the State of Tamilnadu. This would not only be a leap towards the use of Green Energy for VOCPT but also be means of self-reliant and Economical Energy which would capitalize the abundance of Solar Energy.
- 3.0 The selection of the Contractor for the "Tender for Design, Engineering, Supply, Construction, Erection, Testing & Commissioning of 5 MW (AC) grid connected ground based Solar PV Power Plant including 10 years plant O&M at V. O. Chidambaranar Port Trust, Tuticorin, Tamilnadu, India" has been entrusted to Solar Energy Corporation of India Limited (A Government of India Enterprise) incorporated under the Companies Act, 2013, having its Registered Office at 6th Floor, Plate-B, NBCC Office Block Tower-2, East Kidwai Nagar, New Delhi-110 023 (hereinafter referred to as 'SECI' or EMPLOYER). For the purpose of all procurement activities related to the said works, SECI shall be referred to as 'SECI or Employer'.
- 4.0 Employer (SECI), therefore on behalf of the "Owner" V.O Chidambaranar Port Trust (VOCPT), invites bids from eligible bidders to participate in the "Tender for Design, Engineering, Supply, Construction, Erection, Testing & Commissioning of 5 MW (AC) grid connected ground based Solar PV Power Plant including 10 years plant O&M at V. O. Chidambaranar Port Trust, Tuticorin, Tamilnadu, India".
- 5.0 **VOID**
- 6.0 The complete Bidding Documents are available at ISN-ETS portal <https://www.bharat-electronictender.com>, Central Public Procurement portal (CPPP) of GoI at www.eprocure.gov.in as well as on SECI's website <http://www.seci.co.in>. However, for the purpose of participation, the official copy of the bidding documents shall only be downloaded from SECI's e-tendering portal at <https://www.bharat-electronictender.com>, as per the provisions available therein. Accordingly, the online bid also has to be uploaded by the respective bidders at <https://www.bharat-electronictender.com> only & no other mode of participation is permitted for this tender document other than ISN-ETS Portal.
- 7.0 Interested bidders have to necessarily register themselves on the portal <https://www.bharat-electronictender.com> through M/s Electronic Tender.com India Pvt Ltd (ETI), New Delhi to participate in the bidding under this invitation for bids. It shall be the sole

5 MW (AC) SPV Project	Tender No <u>SECI/C&P/PMC/11/0001/2021-22</u>	IFB <u>Page 3 of 10</u>	<u>Signature of Bidder</u>
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responsibility of the interested bidders to get themselves registered at the aforesaid portal for which they are required to contact M/s ETI, New Delhi to complete the registration formalities. The address of M/s ETI is mentioned on the Bid Information Sheet. All required documents and formalities for registering on ETI are mentioned in the subsequent bidding documents.

They may obtain further information regarding this IFB from the registered office of SECI at the address given on the Bid Information Sheet from 10:00 hours to 17:00 hours on all working days till the last date of the Bid Submission.

For proper uploading of the bids on the portal namely <https://www.bharat-electronictender.com> (hereinafter referred to as the 'portal'), it shall be the sole responsibility of the bidders to apprise themselves adequately regarding all the relevant procedures and provisions as detailed in the portal as well as by contacting M/s Electronic Tender.com India Pvt Ltd (ETI), New Delhi directly, as and when required, for which contact details are also mentioned on the Bid Information Sheet. The Employer in no case shall be responsible for any issues related to timely or properly uploading/ submission of the bid in accordance with the relevant provisions of Section II - ITB of the Bidding Documents.

- 8.0 While submitting/ uploading the bids, the system through portal asks to key in the pass-phrase for encryption of the documents. The pass-phrase is required by Employer for opening the bids (Separate for both First Envelopes as well as Second Envelopes). **The same may be submitted on the portal as per the provisions existing for submission of the pass-phrase and as per the details given in ITB.**

In the event, SECI is unable to open the Bids with the given pass-phrase provided by the bidders, Employer on its discretion may give an option through the portal, to the bidder to open its bid as per provisions available on the portal. However, Employer shall not be responsible if bid could not be opened within reasonable time for whatsoever reason. In such a case, the bid shall be sent unopened to 'Archive' on the portal and shall not be considered at all any further.

- 9.0 A Single Stage Two Envelope Bidding Procedure followed by e-Reverse Auction will be adopted and will be processed as detailed in the Bidding Documents. Bidding will be conducted through the competitive bidding procedures as per the provisions of ITB/ BDS and the contract shall be executed as per the provisions of the Contract. It shall be noted that the respective rights of the Employer and the Bidder/ Contractor shall be governed by this Bidding Documents and Contract signed between the Owner and the Contractor for the package.
- 10.0 Bidders should submit their bid proposal online complete in all aspect on or before last date and time of Bid Submission as mentioned on ETS Portal of ISN-ETS at <https://www.bharat-electronictender.com> and as indicated in the Bid Information Sheet.
- 11.0 Bidder shall submit bid proposal along with non-refundable Tender Processing Fees, Earnest Money Deposit (EMD) if applicable/ Bid Securing Declaration complete in all respect as per the Bid Information Sheet. Techno-Commercial bids will be opened as per the Bid Information Sheet in offline/ online presence of authorised representatives of bidders who wish to be present offline/ online. Bid proposals received without the prescribed Tender Processing Fees and Earnest Money Deposit (EMD, if applicable) or Bid Securing Declaration will be rejected.

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In the event of any date indicated is a declared Holiday, the next working day shall become operative for the respective purpose mentioned herein.

12.0 Tender documents which include Eligibility Criteria, Technical Specifications, various Conditions of Contract, Formats etc. can be downloaded from ETS Portal of ISN-ETS at <https://www.bharat-electronictender.com>. It is mandatory to download official copy of Tender Document from ISN-ETS Portal to participate in the Tender. Any amendment(s)/ corrigendum(s)/ clarification(s) with respect to this Tender shall be uploaded on ETI site. The Bidder should regularly check for any Amendment(s)/ Corrigendum(s)/ Clarification(s) on the above mentioned ETI site. The same may also be uploaded on SECI website <http://www.seci.co.in> also. However, in case of any discrepancy, the information available on ETI site shall prevail.

13.0 The Bidder selected shall be responsible for the performance of the following scope of work (more detailed in this tender document):

- (i) Design, Engineering, Supply, Construction, Erection, Testing & Commissioning of 5 MW (AC) grid connected ground based Solar PV Power Plant at V. O. Chidambaranar Port Trust, Tuticorin, Tamilnadu, India”.
- (ii) Comprehensive operation & maintenance of the Solar PV Power Plants for 10 (Ten) years as mentioned in detailed scope of work, after successful commissioning and performance demonstration, as detailed in technical specification, including supply and storage of all mandatory spare parts, consumables, repairs/ replacement of any defective equipment, etc.

The above scope of work is indicative and the detailed scope of work is given in the Scope of Work and Technical Specification (Section - VII) of the Tender Documents.

14.0 EMD/Bid Securing Declaration shall be enclosed in a sealed envelope and shall be submitted in the office of Employer (offline) whose mailing address is mentioned in the Bid Information Sheet.

15.0 Performance Securities as per this tender document shall be furnished by the successful bidder after issuance of Notification of Award (NOA)/ Letter of Intent (LOI)/ Letter of Award (LOA) by the Owner.

16.0 The detailed Qualifying Requirements (QR) are given in the section, “Annexure to BDS”.

17.0 The Employer shall conduct e-Reverse Auction (e-RA), as per provisions of **Instructions to Bidders (ITB)** of Tender documents.

18.0 ***Employer/ Owner reserves the right to cancel/ withdraw this invitation for bids without assigning any reason and shall bear no liability whatsoever consequent upon such a decision.***

INTERPRETATIONS

1. Words comprising the singular shall include the plural & vice versa.
2. An applicable law shall be construed as reference to such applicable law including its amendments or re-enactments from time to time.
3. A time of day shall save as otherwise provided in any agreement or document be construed as a reference to Indian Standard Time.
4. Different parts of this contract are to be taken as mutually explanatory and supplementary to each other and if there is any differences between or among the parts of this contract, they shall be interpreted in a harmonious manner so as to give effect to each part.

The table of contents and any headings or sub headings in the contract has been inserted for case of reference only & shall not affect the interpretation of this agreement.

BID INFORMATION SHEET

The brief details of the tender are as under:

(A)	NAME OF WORK/ BRIEF SCOPE OF WORK/ JOB	<p>Design & engineering, procurement & supply of equipment and materials, testing at manufacturers works, multi – level inspections, packing and forwarding, supply, receipt, unloading and storage at site, associated civil works, services, permits, licences, installation and incidentals, insurance at all stages, erection, testing and commissioning of 5 MW (AC) Grid Interactive ground based Solar PV Power Plant and performance demonstration with associated equipment and materials on turnkey basis at VOCPT in Tamilnadu State along with 10 (Ten) years comprehensive operation and maintenance from the date of commissioning or Operational Acceptance, whichever is later.</p> <p>1. Design, Procurement & Supply and erection of the following, in all respect:</p> <p>1.1 Solar panels including module mounting structures and fasteners.</p> <p>1.2 All power conditioning systems including junction boxes, Inverters/ PCU, DC and AC circuit breaker(s).</p> <p>1.3 All associated electrical works and equipment required for interfacing line/ cable (i.e. transformer(s) – power and</p>
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		<p>auxiliary, breakers, isolators, lightning arrestor(s), LT/other panels, protection system, cables, metering etc., but not limited to) as per technical specifications.</p> <p>1.4 Design, supply, erection, testing & commissioning defined in scope of work/ TS as per project requirement and associated switchgear equipment and metering equipment as per technical specification and state regulations.</p> <p>1.5 All associated civil works, including design and Engineering, for: Earthwork for Site grading, cutting, filling, levelling & compacting, internal Roads, Storm water drainage in the requisite project land as required for development of this Solar PV Power Plant.</p> <p>1.6 Construction of Passage for Cleaning of Solar PV Project.</p> <p>1.7 Construction of rain water drainage, if required.</p> <p>1.8 Setting up of a comprehensive Fire Protection system as per the Hazardous area classification for the site.</p> <p>1.9 Supply of mandatory spares & special tools and tackles.</p> <p>1.10 Demonstration of performance of the plant as per the requirement specified in the bidding documents.</p> <p>1.11 Comprehensive operation & maintenance of the SPV plant for 10 (Ten) years as mentioned in detailed scope of work from the date of commissioning or Operational Acceptance, whichever is later, as detailed in technical specification, including supply and storage of all spare parts, consumables, repairs/ replacement of any defective equipment etc.</p> <p>1.12 Obtaining all associated statutory and regulatory compliances and approvals for successful construction, commissioning and operation of plant.</p> <p>1.13 The detailed scope of work is given in Section VII: Scope of Work, specifications and Drawings of this bidding documents.</p>
(B)	TENDER NO. & DATE	SECI/C&P/PMC/11/0001/2021-22 dated 27.12.2021
(C)	SOURCE OF FUNDS	Employer/Owner as defined in the Bid Data Sheets (BDS) intends to finance the package through domestic funding and own resources.
(D)	TYPE OF TENDER	"Single Stage Two Envelope "online Bidding system followed by e-Reverse Auction.
(E)	BIDDERS ELIGIBLE FOR BIDDING	This bid is open to bidders from within the Owner's/Employer's country only.

(F)	COMPLETION/ CONTRACT PERIOD	As mentioned in Special Conditions of Contract (SCC).					
(G)	COST OF BIDDING DOCUMENTS	Free of cost					
(H)	TENDER PROCESSING FEE	<table border="1"> <tr> <td>APPLICABLE</td> <td>Yes</td> </tr> <tr> <td>NOT APPLICABLE</td> <td></td> </tr> </table> <p>Amount: INR 25000/- (Indian Rupees Twenty-Five Thousand only) inclusive of GST @ 18%</p>		APPLICABLE	Yes	NOT APPLICABLE	
APPLICABLE	Yes						
NOT APPLICABLE							
(I)	EARNEST MONEY DEPOSIT (EMD)	<table border="1"> <tr> <td>APPLICABLE</td> <td></td> </tr> <tr> <td>NOT APPLICABLE</td> <td>Yes</td> </tr> </table> <p>Amount: INR 50,00,000 (Indian Rupees Fifty Lakhs only).</p>		APPLICABLE		NOT APPLICABLE	Yes
APPLICABLE							
NOT APPLICABLE	Yes						
(J)	CONTRACT PERFORMANCE SECURITY	<table border="1"> <tr> <td>APPLICABLE</td> <td>Yes</td> </tr> <tr> <td>NOT APPLICABLE</td> <td></td> </tr> </table>		APPLICABLE	Yes	NOT APPLICABLE	
APPLICABLE	Yes						
NOT APPLICABLE							
(K)	DATE, TIME & VENUE OF PRE-BID MEETING & SITE VISIT	<p>Pre-Bid Meeting 1100 HRS (IST) on 11.01.2022</p> <p>Venue will be intimated subsequent to the release of tender document.</p> <p>Site Visit:</p> <p>Prospective Bidders are advised to visit the proposed Land site to study the actual conditions and go through the plans/ drawings connected to the present scope of work etc including power evacuation system and Ground based Project capacities and get acquainted with the same before attending Pre-bid meeting.</p>					

		For seeking visit of site or any clarifications bidders may contact the AGM, PV SECI.
(L)	OFFLINE & ONLINE BID-SUBMISSION DEADLINE	<u>11.02.202 up to 1400 HRS</u>
(M)	OFFLINE & ONLINE BID OPENING	<u>11.02.2022, 1600 HRS onwards</u>
(N)	FINANCIAL BID OPENING	To be intimated subsequent to the shortlisting of Techno Commercial Bids
(O)	TECHNICAL QUERIES CONTACT DETAILS	<p>Sh Shreedhar Singh Additional General Manager (Projects)</p> <p>Solar Energy Corporation of India Limited (A Government of India Enterprise)</p> <p>6th Floor, Plate-B, NBCC Office Block Tower-2, East Kidwai Nagar, New Delhi-110023, India</p> <p>E mail: shreedhar.singh@seci.co.in Phone: 011-71989200/ 71989293</p>
(P)	CONTACT DETAILS OF ETI	<p>M/s Electronic Tender.com (India) Pvt Ltd Registered Office: 6, Jain Mandir Road, New Delhi-110001 Corporate Office: 1001, City Court, M. G. Road, Gurugram - 122002, Haryana Contact Person: ETS Support Team Contact No.: +91-124-4229071, 4229072 Email: support@isn-ets.com</p>

- 1.0 Bids must be submitted strictly in accordance with Clause no. 11 of ITB depending upon Type of Tender as mentioned at Clause no. (D) of Bid Information Sheet. The IFB is an integral and inseparable part of the Tender document.
- 2.0 Bidder(s) are advised to bid strictly as per terms and conditions of the tender documents and not to stipulate any deviations/ exceptions.
- 3.0 Any bidder, who meets the Qualifying Requirement and wishes to quote against this tender, may download the complete bidding document along with its amendment(s) if any from ETS Portal of ISN-ETS (<https://www.bharat-electronictender.com>) and submit their Bid complete in all respect as per terms & conditions of Tender Document on or before the due date of bid submission.

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- 4.0 No Manual / Hard Copy of the Bid shall be acceptable.
- 5.0 Clarification(s)/ Corrigendum(s) if any shall also be available on above referred websites.
- 6.0 Owner will release NOA/ LOI/ LOA for LSTK (Lump Sum Turn Key)/ EPC (Engineering, Procurement & Commissioning) to the successful bidder. The NOA/ LOI/ LOA for LSTK/ EPC job shall be awarded in following respective parts as mentioned briefly below: -
- (i) **First Contract (Supply & Service Part):** For providing the Design, engineering, manufacture, procure, testing/ inspection, Ex Works Supply, materials including mandatory spares and any other supplies specified in the Tender Documents & providing all services i.e., including Transportation and Insurance of all equipment's till site , Unloading, Storage, Handling at Site, Civil Works, Erection, Installation, Testing and Commissioning including Performance Testing in respect of all the equipment's supplied under the scope of Supply and any other services specified in the Contract Documents.
- (ii) **Second Contract (O&M Part):** For providing Comprehensive operation & maintenance of the Solar PV plant for 10 (Ten) years from the date of Operational Acceptance, as detailed in technical specification including supply and storage of all spare parts, consumables, repairs/ replacement of any defective equipment etc.
- 7.0 However, the above-mentioned contract award methodology may be modified/ changed based on specific project requirements and upon sole discretion of Owner.



SECTION - II

INSTRUCTION TO BIDDERS (ITB)

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8. CLARIFICATION OF TENDER DOCUMENTS
9. AMENDMENT OF TENDER DOCUMENTS

[C] PREPARATION OF BIDS:

10. LANGUAGE OF BID
11. DOCUMENTS COMPRISING THE BID
12. SCHEDULE OF RATES/ PRICE SCHEDULE/ BID PRICES
13. GOODS & SERVICE TAX
14. BID CURRENCIES
15. BID VALIDITY
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17. PRE-BID MEETING
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2. ANNEXURE-II: ADDENDUM TO INSTRUCTIONS TO BIDDERS (INSTRUCTION FOR PARTICIPATION IN E-TENDER)

Preamble

This part (Section - II) of the Tender Documents provides the information necessary for bidders to prepare responsive bids, in accordance with the requirements of the Employer/ Owner. It also provides information on bid submission and uploading the bid on portal <https://www.bharat-electronictender.com>, bid opening, evaluation and on contract award. This Section (Section - II) contains provisions that are to be used unchanged unless Section - III (Bid Data Sheets) and Section - V (Special Conditions of Contract), which consists of provisions that supplement, amend, or specify in detail, information or requirements included in ITB and that are specific to each procurement, states otherwise.

However, provisions governing the performance of the Contractor, payments under the contract or matters affecting the risks, rights and obligations of the parties under the contract are not included in this section but instead under Section - IV (General Conditions of Contract) and/ or Section - V (Special Conditions of Contract).

Bidders may note that the respective rights of the Employer/ Owner and Bidders/ Contractors shall be governed by the Tender Documents and Contracts signed between the Employer/ Owner and the Contractor. The provisions of Tender Documents shall always prevail over any other documents in case of contradiction.

Further in all matters arising out of the provisions of this Tender document, the laws of the Union of India shall be the governing laws and the respective courts of Owner/Site shall have exclusive jurisdiction.

[A] - GENERAL

1 SCOPE OF BID

- 1.1 The Employer/ Owner, wishes to receive Bids as described in the Bidding documents/ Tender documents issued by Employer/ Owner.
- 1.2 SCOPE OF BID: The scope of work/ Services shall be as defined in the Tender documents.
- 1.3 The successful bidder will be expected to complete the entire scope of work within the period stated in Section - V, Special Conditions of Contract.
- 1.4 Day' means 'Calendar Day' and 'Singular' also means 'Plural'.

2 ELIGIBLE BIDDERS

- 2.1 The Bidder shall not be under a declaration of ineligibility by Employer for Corrupt/ Fraudulent/ Collusive/ Coercive practices, as defined in "Instructions to Bidders [ITB], Clause no. 39" (Action in case Corrupt/ Fraudulent/ Collusive/ Coercive Practices).
- 2.2 The Bidder (either individually or as a consortium or any of the participating members of the Consortium) shall not have been debarred by Employer/ Owner/ Ministry of New & Renewable Energy (MNRE) or any other ministries and / or any other Government Department, Agencies or CPSUs from future bidding due to "poor performance" or "corrupt and fraudulent practices" or any other reason in the past.

If the tender documents were issued inadvertently/ downloaded, offers submitted by such bidders shall not be considered for opening/ evaluation/ Award and will be returned to such bidders.

It is the sole responsibility of the Bidder to have informed SECI about any change in status of the declaration (if any) prior to award of contract, the same has to be informed promptly to Employer/ Owner by the bidder.

It shall be the sole responsibility of the bidder to inform Employer/ Owner in case the bidder is debarred from bidding by Employer/ Owner or Public Sector Project Management Consultant. Concealment of the facts shall tantamount to misrepresentation of facts and shall lead to action against such Bidders as per clause no. 39 of ITB.

- 2.3 The Bidder should not be under any liquidation court receivership or similar proceedings on the due date of submission of bid.

In case there is any change in status of the declaration prior to award of contract, the same has to be promptly informed to Employer/ Owner by the bidder.

It shall be the sole responsibility of the bidder to inform Employer/ Owner in case the bidder is under any liquidation court receivership or similar proceedings on due date of submission of bid and during the course of finalization of the tender. Concealment of the facts shall tantamount to misrepresentation of facts and shall lead to action against such Bidders as per

clause no. 39 of ITB.

2.4 Bidder shall not be affiliated with an entity:

- (i) that has provided consulting services related to the work to the Employer/ Owner during the preparatory stages of the work or of the project of which the works/ services forms a part of or
- (ii) that has been hired (proposed to be hired) by the Employer/ Owner as an Engineer/ Consultant for the contract.

2.5 Neither the entity [appointed as the Project Management Consultant (PMC)/Consultancies for a contract] nor its affiliates/ JV's/ Subsidiaries shall be allowed to participate in the tendering process.

2.6 Pursuant to qualification criteria set forth in the bidding document, the Bidder shall furnish all necessary supporting documentary evidence to establish Bidder's claim of meeting qualification criteria as mentioned in the Annexure to BDS.

3 BIDS FROM CONSORTIUM/ JOINT VENTURE

3.1 Unless otherwise specified in the Bid Data sheet (BDS), Bids from Consortium/ Joint Venture are allowed. However, the eligibility criteria along with other terms and conditions (as mentioned in clause no. 1.4 of Annexure to BDS) shall be complied upon.

4 NUMBER OF BIDS PER BIDDER

4.1 Unless otherwise specified in the Bid Data sheet (BDS), a Bidder shall submit only 'one [01] Bid' in the same Bidding Process. A Bidder who submits or participates in more than 'one [01] Bid' will cause all the proposals in which the Bidder has participated to be disqualified.

5 COST OF BIDDING & TENDER PROCESSING FEE

5.1 COST OF BIDDING

The Bidder shall bear all costs associated with the preparation and submission of the Bid including but not limited to Bank charges, all courier charges including taxes & duties etc. incurred thereof. Further, Employer/ Owner will in no case, be responsible or liable for these costs, regardless of the outcome of the bidding process.

5.2 TENDER PROCESSING FEE (NON-REFUNDABLE)

5.2.1 A non- refundable Tender Processing Fee, if applicable, is to be submitted in the form of 'either through NEFT/ RTGS transfer in the account of SECI or Demand Draft/ Banker's Cheque in favour of "Solar Energy Corporation of India Limited, New Delhi" payable at New Delhi. The Tender Processing Fee is to be submitted along with the bid for the amount as mentioned in the Bid Information Sheet attached under Section - I (Invitation for Bids, IFB). Bids submitted without payment of requisite Tender Processing Fee will be treated as non-responsive and

shall be liable for rejection.

- 5.3 **The Tender Processing Fee and EMD, if applicable is exempted for MSME Vendors registered under NSIC/ Udyog Aadhaar/DIC Category only. In order to avail the exemption in Tender Processing Fee in case of consortium/ JV, all the members should be registered as MSME Vendors under NSIC/ Udyog Aadhaar Category/DIC.**
- 5.4 In case of any discrepancy/ non-submission of either offline or online bid documents by the bidder, the tender processing fee will be deemed as bidder's consent for participation in the bidding process. Henceforth, the tender processing fee shall be retained by Employer and shall not be returned under any circumstances. No plea in this regard shall be entertained by the Employer/ Owner. However, EMD, if applicable will be returned in this case.
- 5.5 In the event of a particular tender being cancelled at any stage, the tender processing fee will be refunded to the concerned bidders without any interest charges within 30 days from the date of notification of cancellation of tender. No plea in this regard shall be entertained by the Employer/ Owner. EMD, if applicable will also be returned in this case

6 SITE VISIT

- 6.1 The Bidder is advised to visit and examine the site of works and its surroundings and obtain for itself on its own responsibility all information that may be necessary for preparing the Bid and entering into a Contract for the required job. The costs of visiting the site shall be borne by the Bidder.
- 6.2 The Bidder or any of its personnel or agents shall be granted permission by the Employer/ Owner to enter upon its premises and land/Area for the purpose of such visits, but only upon the express conditions that the Bidder, its personnel and agents will release and indemnify the Employer/ Owner and its personnel, agents from and against all liabilities in respect thereof, and will be responsible for death or injury, loss or damage to property, and any other loss, damage, costs, and expenses incurred as a result of inspection.
- 6.3 The Bidder shall not be entitled to hold any claim against Employer/ Owner for non-compliance due to lack of any kind of pre-requisite information as it is the sole responsibility of the Bidder to obtain all the necessary information with regard to site, surrounding, working conditions, weather etc. on its own before submission of the bid.

[B] - BIDDING DOCUMENTS

7 CONTENTS OF TENDER DOCUMENTS

- 7.1 The contents of Tender Documents are those stated below, and should be read in conjunction

5 MW (AC) SPV Project	Tender No <u>SECI/C&P/PMC/11/0001/2021-22</u>	ITB <u>Page 7 of 47</u>	<u>Signature of Bidder</u>
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with any 'Addendum/ Corrigendum' issued in accordance with "ITB: Clause-9":

- Section-I : Invitation for Bids [IFB]
- Section-II : Instructions to Bidders [ITB]
- Section-III : Bid Data Sheets [BDS]
Annexure to Bid Data Sheets [Qualifying Requirements]
- Section-IV : General Conditions of Contract [GCC]
- Section-V : Special Conditions of Contract [SCC]
- Section-VI : Sample Forms and Formats
- Section-VII : Scope of Work & Technical Specifications
- Section-VIII : Schedule of Rates [SOR]/ Price Schedule [PS]/ Format for Price Bid

- 7.2 The Bidder is expected to examine all instructions, forms, terms & conditions in the Tender Documents. The entire Tender Documents together with all its amendments, clarifications and attachments thereto, shall be considered to be read, understood and accepted by the Bidders. Failure to furnish all information required by the Tender Documents or submission of a Bid not substantially responsive to the Tender Documents in every respect will be at Bidder's risk and may result in the rejection of his Bid. However, Employer/ Owner at its sole discretion may seek clarifications from the Bidders to adjudge the exact content and facts of the Tender Documents.

8 CLARIFICATION OF TENDER DOCUMENTS

- 8.1 A prospective Bidder requiring any clarification(s) of the Tender Documents may notify Employer in writing by E-mail or at Employer's mailing address indicated in the Bid Information Sheet no later than 02 (Two) working days after the pre-bid meeting (in cases where pre-bid meeting is scheduled) or 15 (Fifteen) days prior to the bid closing date (in cases where pre-bid meeting is not held). Employer reserves the right to ignore the bidders request for clarification if received beyond the aforesaid period. Employer may respond in writing to the request for clarification. Employer's response including an explanation of the query, but without identifying the source of the query will be uploaded on ETS Portal of ISN-ETS <https://www.bharat-electronictender.com> and/ or Employer's website www.seci.co.in.
- 8.2 Any clarification or information required by the Bidder but same not received by the Employer at clause 8.1 above is liable to be considered as "no clarification/ information required".
- 8.3 Clarifications sought by the bidders are to be mandatorily submitted in the SECI provided format only provided along with the Tender document. Pre-Bid queries submitted in any other format will not be considered.

9 AMENDMENT OF TENDER DOCUMENTS

- 9.1 At any time prior to the 'Bid Due Date', Employer/ Owner may, for any reason, whether at its own initiative or in response to a clarification requested by a prospective Bidder, modify the Tender Documents by addenda/ corrigendum.
- 9.2 Any addendum/ corrigendum thus issued shall be part of the Tender Documents and shall be hosted on ETS Portal of ISN-ETS <https://www.bharat-electronictender.com> and/ or Employer's website www.seci.co.in. Bidders have to take into account all such addendum/

corrigendum before submitting their bid.

- 9.3 The Employer, if consider necessary, may extend the date of submissions of Bid in order to allow the Bidders a reasonable time to furnish their most competitive bid taking into account the amendment issued thereof.

[C] - PREPARATION OF BIDS

10 LANGUAGE OF BID:

The bid prepared by the bidder and all correspondence/ drawings and documents relating to the bid exchanged by bidder and Employer/ Owner shall be written in English language alone. Any printed literature furnished by the bidder may be written in another language as long as accompanied by an ENGLISH translation duly authenticated by the Chamber of Commerce/ Certified Translator of bidder's country, in which case, for the purpose of interpretation of the bid, the ENGLISH translation shall govern.

In the event of submission of any document/ certificate by the Bidder in a language other than English, the English translation of the same duly authenticated by Chamber of Commerce/ Certified Translator of Bidder's country shall be submitted by the Bidder.

11. DOCUMENTS COMPRISING THE BID

The bid shall be submitted by the Bidder under "Single Stage - Two Envelope" procedure of bidding. Under this procedure, the bid submitted by the Bidder in two envelopes - First Envelope (also referred to as Techno - Commercial Part) and Second Envelope (also referred to as Price Part) shall comprise of the following documents:

I. Offline Documents

Offline documents of the bid shall comprise of following documents to be submitted in sealed envelope, as part of First Envelope. **The envelope shall bear {the name of Tender, the Tender No. and the words 'DO NOT OPEN BEFORE' (due date & time)}.**

Contact Persons Name: Mr Sandeep Kumar

- (a) Original Non-Refundable Tender Processing Fee as per clause no. 05 of ITB
- (b) Original Non-Refundable Cost of Tender Document, if applicable
- (c) 'Covering Letter' on Bidder's 'Letterhead' (in Original) clearly specifying the enclosed contents, as per 'Form F-0'
- (d) EMD, in original as per Clause 16 of ITB as per 'Form F-4A' or as prescribed.
- (f) Power of Attorney for authorized signatory in non-judicial stamp paper (as per 'Form F-24')
- (g) Copy of Board Resolution
- (h) The Pass-Phrase to decrypt the relevant Bid-Parts (for both Techno-Commercial and Financial) in separate sealed envelopes before the start date and time of the Tender Opening Event (TOE)

Bidder shall also upload the scanned copies of all the above-mentioned original documents during online Bid Submission as a part of First envelope.

“Bidder should explicitly note that no offline documents are to be submitted as a part of Second envelope”.

II. Online Documents/Soft Copy

Online documents/Soft copy of the bid shall comprise of following documents to be uploaded on the ISN-ETS portal <https://www.bharat-electronictender.com> as per provisions therein.

II (a) As part of First Envelope

- (a) The Electronic Form of the bid for First Envelope (Techno-Commercial), as available on the ISN-ETS portal, shall be duly filled.
- (b) Scanned copies of all the above-mentioned original documents during online Bid Submission as a part of First envelope and Bid Form for first envelope.
- (c) Certificate of Incorporation
- (d) 'Bidder's General Information', as per 'Form F-1'.
- (e) 'No Deviation Confirmation', as per 'Form F-6'
- (f) 'Bidder's Declaration regarding Banning, Liquidation etc.', as per 'Form F-7'
- (g) 'Declaration on restriction on procurement from certain countries.', as per 'Form F-8'
- (h) 'Declaration regarding the procurement of Solar Inverters & Solar Modules from class I local suppliers, as per 'Form F-12'
- (i) 'Bidders Experience as per 'Form F-13'
- (j) Disclosure for ALMM compliance as per 'Form F-14'
- (k) Format of Chartered Accountant certificate for financial capability of the bidder as per 'Form F-16'
- (l) 'E-Banking Format as per 'Form F-19'
- (m) 'Shareholding Certificate' as per 'Form F-23'
- (n) 'Format for Cyber Security Agreement' as per 'Form F-25'
- (o) 'Undertaking regarding Site Condition' as per 'Form F-26'
- (p) Documents in accordance with the "Qualifying Requirements (QR)" establishing the qualification
- (q) Document showing annual turnover for the financial years as required in Qualifying Requirements (QR) such as annual reports, profit and loss account, net worth etc. along with information as sought in enclosed Format F-16
- (r) Tender Document. (Only First and Last Pages of Original Tender Document duly sealed and signed/ digitally signed and all pages of amendments to Tender Documents duly sealed and signed/ digitally signed by the Authorized Signatory).

II (b) As part of Second Envelope

- (a) The Electronic Form of the bid for Second Envelope (Price - Part), as available on the ISN-ETS portal, shall be duly filled. “Termed as **ELECTRONIC FORM**”

- (b) Main Price Bid comprising of SOR-1 & SOR-2 of the Price Schedule (available in Section - VIII, SOR), duly completed, sealed and signed/ digitally signed shall be uploaded. "Termed as **MAIN BID**".

SOR -1 is the Schedule and Breakup of Lump sum Price (Supply, Service and NPV of O&M) of the Tender. SOR -2 comprises of the yearly Breakup of the NPV of O&M price for 10 years period.

12 SCHEDULE OF RATES (SOR)/ PRICE SCHEDULE (PS)/ BID PRICES

- 12.1 Unless stated otherwise in the Tender Documents, the Contract shall be for the whole works as described in Tender Documents, based on the rates and prices submitted by the Bidder and accepted by the Employer/ Owner. The prices quoted by the Bidders should indicate clearly the Goods & Service Tax (GST) components as also mentioned under the SoR.
- 12.2 Prices must be filled in format for "Schedule of Rates [SOR]/ Price Schedule [PS]/ Bid Prices" enclosed as part of Tender documents under Section - VIII. If quoted in separate typed sheets, such bids may be rejected.
- 12.3 Bidder shall quote for all the items of "SOR/ PS" after careful analysis of cost involved for the performance of the completed item considering all parts of the Tender Document. In case any activity though specifically not covered in description of item under "SOR/ PS" but is required to complete the works as per Specifications, Scope of Work/ Service, Standards, "GCC", "SCC" or any other part of Bidding Document, the prices quoted shall deemed to be inclusive of cost incurred for such activity.
- 12.4 All Goods & Service Tax (GST) components [applicable for both Centre and state] payable by the Contractor under the Contract, or for any other cause, shall be mentioned as per the SOR formats SOR-1 & SOR-2.
- 12.5 Prices quoted by the Bidder, shall remain FIRM and Fixed and valid until completion of the Contract and will not be subject to variation on any account.
- 12.6 In case of any variation (positive/ negative) in existing rates of taxes/ duties/ levies or a new tax/ duty/ levy is introduced or any existing tax/ duty/ levy is abolished or application of any Tax in the course of the performance of this Contract, which will/ may impact the overall pricing in connection with performance of the Contract, an equitable adjustment of the Contract Price shall be made to factor any such change by addition to the Contract Price or deduction therefrom, as the case may be. All these adjustments would be carried out by considering the base price of taxes equivalent to the amount mentioned under taxes and duties column of the SOR/ PS.

The term Change in Law shall refer to the occurrence of any of the following events pertaining to this project only after the last date of the bid submission, including (i) the enactment of any new law; or (ii) an amendment, modification or repeal of an existing law; or (iii) any change in the rates of any Taxes including any duties and cess or introduction of any new tax made

applicable for setting up the project.

However, Change in Law shall not include (i) any change in taxes on corporate income or (ii) any change in any withholding tax on income or dividends distributed to the shareholders of the Contractor, or (iii) any change on account of regulatory measures by the Appropriate Commission.

12.7 The Bidder shall quote the prices in 'figures' & words. There should not be any discrepancy between the prices indicated in figures and the price indicated in words. In case of any discrepancy, the same shall be dealt as per clause no. 30 of ITB.

12.8 Bidder need to submit the detailed break-up of Goods & Service Tax (GST) (applicable for both Central and State) in the SOR formats viz SOR-1 & SOR-2. This data is required to ascertain the

a) Computation of taxes assumed at the time of bidding.

b) The total impact due to revision in applicable tax rate or introduction of new tax, if any.

Bidders are required to ascertain the correctness of amount related to Goods & Service Tax (GST) as mentioned in the SOR/ PS as on the date of techno-commercial bid submission as it will impact the Price assessment part at the time of evaluation of price bid.

13 **Goods & Service Tax (GST)**

Contractor shall mandatorily obtain the registration under GST Law at Central level and/or in respective State as may be required. Further, Contractor shall mandatorily file returns under GST before their due date & comply with the requirements of the Law within timelines. Before releasing the payment to the Contractor. Owner shall not be responsible for any delay in payment release to the contractor in case the GST compliance is not fulfilled from the contractor side in any manner.

Contractor shall be responsible to comply with all the requirements of applicable provisions of GST. Contractor has to mandatorily get registered under GST at Central and relevant State(s). Contractor shall file all the returns on timely basis and upload all the Invoices and acceptance thereof as may be required under the provisions of GST. In case, it is found that Owner is not able to take Input Tax Credit (ITC) benefit of the taxes due to any fault of the Contractor, Owner shall be constrained to deduct the amount from the payments to be made to the Contractor or recover the same in any other manner.

13.1 Bidders are required to submit a copy of the GST Registration Certificate or GST provisional certificate while submitting the bids wherever GST tax is applicable.

13.2 The responsibility of payment of GST lies with the Service Provider only. Contractor providing taxable service shall issue an Invoice, a Bill or as the case may be, a Challan which is signed, serially numbered and in accordance with rule GST Law. The invoice shall also contain the

following:

- (a) Name, Address & Registration No. of such Person/ Contractor
- (b) Name & Address of the Person/ Contractor receiving Taxable Service
- (c) Description, Classification & Value of Taxable Service provided
- (d) GST Amount, if any.
- (e) HSN code of the Goods/Services.

Payments to Service Provider for claiming GST amount will be made provided the above formalities are fulfilled. Further, Employer/ Owner may seek copies of challan and certificate from Chartered Accountant for deposit of GST collected from Employer/ Owner.

- 13.3 In case CBIT (Central Board of Indirect Taxes and Customs) brings to the notice of Employer/ Owner that the contractor has not remitted the amount towards GST collected from Employer/ Owner to the government exchequer, then, that contractor may be debarred from bidding in future tenders of Employer/ Owner for given period as per the sole discretion of Employer/ Owner.
- 13.4 In case of statutory variation in GST during currency of the Contract, the Contractor shall submit a copy of the 'Government Notification' to evidence the rate as applicable on the date of submission of Bid and on the date of revision. Claim for payment of GST / Statutory variation in GST, should be raised within two [02] months from the date of issue of 'Government Notification' for payment of differential (in %) GST, otherwise claim in respect of above shall not be entertained for payment of arrears. The following may also be noted: -
 - a) Any increase in the rate of Non ITC based GST beyond the contractual completion period shall be to contractor's account whereas any decrease in the rate shall be passed on to the Employer/ Owner.
 - b) The base date for the purpose of applying statutory variation shall be the last date of bid submission.
- 13.5 Owner will reimburse the GST to the Contractor at actuals against submission of ITC based invoices issued in accordance with GST rules. In case of any variation in the executed quantities, the amount on which the GST is applicable shall be modified in same proportion.
- 13.6 Owner will reimburse the GST to the Contractor at actuals against documentary evidence subject to the ceiling amount of GST as quoted by the bidder, subject to any statutory variations. In case of any variation in the executed quantities (If directed and/ or certified by the Engineer-In-Charge) the ceiling amount on which GST is applicable will be modified on pro-rata basis.
- 13.7 Contractor shall ensure timely submission of correct invoice(s) with all required supporting

document(s) so to enable Owner to avail Input Tax Credit (ITC) (If applicable)

14 **BID CURRENCIES:**

Bidders must submit bid in the currency as mentioned Bid Data Sheet.

15 **BID VALIDITY**

15.1 Bids shall be kept valid for period specified in BDS from the final 'Bid Opening Date'. A Bid valid for a shorter period may be rejected by Employer as 'non-responsive'.

15.2 In exceptional circumstances, prior to expiry of the original 'Bid Validity Period', the Employer may request the Bidders to extend the 'Period of Bid Validity' for a specified additional period. The request and the responses thereto shall be made in writing or by email. A Bidder may refuse the request without forfeiture of his 'EMD, if applicable will '. A Bidder agreeing to the request will not be required or permitted to modify his Bid, but will be required to extend the validity of its 'EMD, if applicable will ' for the period of the extension and in accordance with "ITB: Clause-16" in all respects.

Note: In case of extension(s) of last due date of the Tender submission, the latest extension issued shall be considered as the final due date of Tender submission and accordingly the Tender validity should be calculated and sufficed. The validity of the Tender need to be revised by respective bidders, in case the bids are already submitted prior to the last due date of the initial Tender submission deadline.

16 **EARNEST MONEY DEPOSIT (EMD)**

16.1 The applicability/Non-applicability of Earnest Money Deposit (EMD) is specified under BDS.

16.2 The Bids must be accompanied with '**Earnest Money Deposit (EMD)**' in the form of either through NEFT/ RTGS transfer in the account of SECI or '**Demand Draft**' or '**Banker's Cheque**' [in favour of **Solar Energy Corporation of India limited, New Delhi payable at New Delhi**] or '**Bank Guarantee**' as per the format given in **Form F - 4 of the bidding documents**. Bidders shall ensure that EMD, having a validity of at least 30 (Thirty) Days beyond the validity of the bid, must accompany the Bid in the format(s) made available in the Tender Document. In case of any extension in validity of bid, the EMD shall be extended suitably. The EMD shall be submitted in Indian Rupees only.

16.3 The '**EMD**' is required to protect Employer/ Owner against the risk of Bidder's conduct, which would warrant the EMD's forfeiture, pursuant to "ITB: Clause-16.8".

16.4 Employer/ Owner shall not be liable to pay any Bank charges, commission or interest etc. on the amount of 'EMD'. In case 'EMD' is in the form of a 'Bank Guarantee', the same shall be from any scheduled Bank as specified in the List of Banks enclosed at Form F-22, Section-VI of Tender documents or a branch of an International Bank situated in India and registered with 'Reserve Bank of India' as Scheduled Foreign Bank. However, in case of 'Bank Guarantee' from Banks other than the Nationalized Indian Banks, the Bank must be commercial bank

having net worth in excess of INR 500 Crores (Indian Rupees Five Hundred Crores Only).

- 16.5 Bid not accompanied with required amount of EMD shall be liable for rejection.
- 16.6 'Earnest Money Deposit' of all the unsuccessful Bidders disqualified at the stage of Techno-Commercial evaluation, E-Ra shortlisting or during/after E-Ra process will be discharged/ returned as promptly as possible, but not later than '30 [thirty] days' of their respective disqualification.
- 16.7 The successful bidder's (L1 bidder) 'Earnest Money Deposit' will be discharged upon the Bidder's signing the 'Contract Agreement' and furnishing the 'Performance Security duly vetted by the Bank'.
- 16.8 Notwithstanding anything contained herein, the 'EMD' may also be forfeited in any of the following cases:
- (a) If a Bidder withdraws or varies his Bid during the 'Period of Bid Validity'
 - (b) If a Bidder has indulged in corrupt/ fraudulent/ collusive/ coercive practice
 - (c) Violates any other condition, mentioned elsewhere in the tender document including deviations or conditional bid.
 - (d) In the case of a successful Bidder, if the Bidder fails to:
 - (i) acceptance of the NOA/ LOI/ LOA.
 - (ii) to furnish "Performance Security.
 - (iii) to accept 'arithmetical corrections' as per provision of the clause 30 of ITB.
- 16.9 In case EMD is in the form of 'Bank Guarantee', the same must indicate the Bid Document No and the Work for which the Bidder is quoting. This is essential to have proper correlation at a later date. The 'EMD' should be in the form provided at 'Form F-4A'.

Note: In case of extension(s) of last due date of the Tender submission, the latest extension issued shall be considered as the final due date of Tender submission and accordingly the Earnest Money Deposit validity and Bid validity should be calculated and sufficed. The validity of the submitted EMD and bid validity need to be revised by respective bidders, in case the bids are already submitted prior to the last due date of the initial Tender submission deadline.

17 PRE-BID MEETING

- 17.1 The Bidder(s) or his designated representative are invited to attend a "Pre-Bid Meeting" which will be held at address specified in Bid Information Sheet under Section - I, Invitation for Bids, IFB. It is expected that a bidder shall not depute more than 02 representatives for the meeting.
- 17.2 Purpose of the meeting will be to clarify issues and to answer questions on any matter that may be raised at that stage.
- 17.3 Text of the questions raised and the responses given, together with any responses prepared after the meeting, will be uploaded on SECI & ETI website against the Tender. Any modification of the Contents of Tender Documents listed in "ITB: Clause-7.1", that may become necessary as a result of the Pre-Bid Meeting shall be made by the Employer/ Owner

exclusively through the issue of an Addendum/ Corrigendum pursuant to "ITB: Clause-9", and not through the minutes of the Pre-Bid Meeting.

17.4 Non-attendance of the Pre-Bid Meeting will not be a cause for disqualification of Bidder.

18 **SIGNING OF BID/TENDER DOCUMENT**

18.1 The First and Last Pages of original tender documents including amendments, clarifications if any shall be typed or written in indelible ink [in the case of copies, photocopies are also acceptable] and shall be signed by a person or persons duly authorized to sign on behalf of the Bidder (as per POA) before uploading at ISN-ETS online portal. The name and position held by each person signing, must be typed or printed below the signature.

19 **ZERO DEVIATION AND REJECTION CRITERIA**

19.1 **ZERO DEVIATION** : Deviation to terms and conditions of Tender Documents may lead to rejection of bid. Employer/ Owner will accept bids based on terms & conditions of Tender Documents only. Bidder may note Employer/ Owner will determine the substantial responsiveness of each bid to the Tender Documents pursuant to provision contained in clause 29 of ITB. For purpose of this, a substantially responsive bid is one which conforms to all terms and conditions of the Tender Documents without deviations or reservations. Employer's/ Owner's determination of a bid's responsiveness is based on the content of the bid itself. Employer/ Owner reserves the right to raise technical and/ or commercial query(ies), if required. The response(s) to the same shall be in writing, and no change in the price(s) or substance of the bids shall be sought, offered or permitted. The substance of the bid includes but not limited to prices, completion, scope, technical specifications, etc. Bidders are requested to not to take any deviation.

19.2 **REJECTION CRITERIA:** Notwithstanding the above, deviation to the following clauses of Tender document shall lead to summarily rejection of Bid:

- (a) Eligibility Criteria including General, Technical and Financial Qualifying Requirements
- (b) Firm Price
- (c) Tender Processing Fees and Earnest Money Deposit
- (d) Tender Document Fees, if applicable
- (e) Specifications & Scope of Work
- (f) Schedule of Rates (SOR)/ Price Schedule (PS)
- (g) Duration/ Period of Contract/ Completion schedule
- (h) Period of Validity of Bid
- (i) Warrantee/Guarantee/ Defect Liability Period
- (j) Arbitration/ Resolution of Dispute/ Jurisdiction of Court
- (k) Force Majeure & Applicable Laws
- (l) Any other condition specifically mentioned in the tender document elsewhere that non-compliance of the clause lead to rejection of bid

Note: Further, it is once again reminded not to mention any condition in the Bid which is

contradictory to the terms and conditions of Tender document.

20 **E-PAYMENT**

Owner has initiated payments to Suppliers and Contractors electronically, and to facilitate the payments electronically through '**e-banking**'. The successful bidder should give the details of his bank account as per the bank mandate form enclosed at Format F-19 in Section-VI, Sample Forms and Formats of the Tender documents.

[D] - SUBMISSION OF BIDS

21 **SUBMISSION, SEALING AND MARKING OF BIDS**

- 21.1 Bids shall be submitted through e-tender mode in the manner specified elsewhere in tender document.
- 21.2 Offline documents (Specific documents only) as mentioned in clause no. 11.I of Section - II, Instructions to Bidders (ITB) of the Tender document shall be submitted in a Sealed Covering Envelope. The Covering Envelope shall have the following Sticker

Offline Tender Document for “Tender for Design, Engineering, Supply, Construction, Erection, Testing, commissioning and O&M of 5 MW (AC) grid connected ground based Solar PV Power Plant at V O Chidambaranar, Tuticorin, Tamilnadu, India”	
Tender Document No.	SECI/C&P/PMC/11/0001/2021-22
Last Date of Submission	
Bids Submitted by	(Enter Full name and address of the Bidder)
Authorized Signatory	(Signature of the Authorized Signatory) (Name of the Authorized Signatory) (Stamp of the Bidder)
Bid Submitted to	Solar Energy Corporation of India Limited (A Government of India Enterprise) 6th Floor, Plate-B, NBCC Office Block Tower-2, East Kidwai Nagar, New Delhi-110023, India

21.3 All the bids shall be addressed to the Employer at address specified in the Bid Information Sheet in Section - I, Invitation for Bids (IFB).

21.4 Bids submitted under the name of AGENT/ CONSULTANT/ REPRESENTATIVE/ RETAINER/ ASSOCIATE etc. on behalf of a bidder/ affiliate shall not be accepted.

22 DEADLINE FOR SUBMISSION OF BIDS

22.1 The bids must be submitted through e-tender mode not later than the date and time specified in the Bid Information Sheet in Section - I, Invitation for Bids (IFB).

22.2 The offline documents of required specific documents must be submitted through courier/ registered post/ by hand not later than the date and time specified in the Bid Information Sheet in Section - I, Invitation for Bids (IFB)/BDS

22.3 Employer/ Owner may, in exceptional circumstances and at its discretion, extend the deadline for submission of Bids (clause 9 of ITB refers). In which case all rights and obligations of Employer/ Owner and the Bidders, previously subject to the original deadline will thereafter be subject to the deadline as extended. Notice for extension of bid submission date will be uploaded on ETS Portal of ISN-ETS <https://www.bharat-electronictender.com> and/ or Employer's website www.seci.co.in.

23 LATE BIDS

23.1 Any bids received after the notified date and time of closing of tenders will be treated as late bids.

23.2 E-tendering system shall close immediately after the deadline for submission of bid and no bids can be submitted thereafter.

23.3 Unsolicited Bids or Bids received to address other than one specifically stipulated in the tender document will not be considered for evaluation/ opening/ award if not received to the specified

destination within stipulated date & time.

24 MODIFICATION AND WITHDRAWAL OF BIDS

24.1 Modification and withdrawal of bids shall be as follows: -

The bidder may withdraw or modify its bid after bid submission but before the due date and time for submission as per tender document with the due written consent from the authorized signatory of the bidder.

24.2 The modification shall also be prepared, sealed, marked and dispatched in accordance with the provision of the clause 21 of ITB, with the outer and inner envelopes additionally marked modification or withdrawal as appropriate. A withdrawal notice may also be sent by e-mail or fax but followed by a signed confirmation copy post not later than the deadline for submission of bids. No bid shall be modified/ withdrawn after the deadline for submission of bids.

24.3 No bid shall be allowed to be withdrawn/ modified/ substitute in the interval between the deadline for submission of bids and the expiration of the period of bid validity specified by the bidder on the Bid Form. Withdrawal/ Modification/ Substitution of a bid during this interval shall result in the forfeiture of bidder's EMD, if applicable pursuant to clause 16 of ITB and rejection of bid.

24.4 The latest bid hence submitted shall be considered for evaluation and all other bids shall be considered to be unconditionally withdrawn.

24.5 In case after price bid opening the lowest evaluated bidder (L1) is not awarded the job for any mistake committed by him in bidding or withdrawal of bid or modification of bid or varying any term in regard thereof leading to re-tendering, Employer shall forfeit EMD, if applicable paid by the bidder and such bidders shall be debarred from participation in re-tendering of the same job(s)/ item(s). Further, such bidder will be debarred for a given period as decided by Employer/ Owner after following the due procedure.

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

Employer/ Owner reserves the right to accept or reject any Bid, and to annul the Bidding process and reject all Bids, at any time prior to award of Contract, without thereby incurring any liability to the affected Bidder or Bidders or any obligations to inform the affected Bidder or Bidders of the ground for Employer's/ Owner's action. However, Bidder if so desire may seek the reason (in writing) for rejection of their Bid to which Employer/ Owner shall respond quickly.

[E] - BID OPENING AND EVALUATION

26 BID OPENING

26.1 *Unpriced Bid Opening:*

As the case may be, Employer will open bids, in the presence of bidders' designated representatives who choose to attend, at date, time and location stipulated in the BDS. The bidders' representatives, who are present shall sign a bid opening register evidencing their

attendance. However the presence of bidder(s) during unpriced bid opening is subjective and will depend on case to case basis against the sole discretion of Employer/ Owner. As it's an online bidding system, Bidder's attendance during the Techno-commercial Bid opening in Employer's Premises is not envisaged, as the same may be observed by the respective bidders from their online login credentials of the e-tendering portal.

26.2 ***Priced Bid Opening:***

26.2.1 Employer will open the price bids of those bidders who meet the qualification requirement and whose bids are determined to be technically and commercially responsive.

26.2.2 The price bids of those bidders who were not found to be techno-commercially responsive shall not be opened.

26.2.3 As it's an online bidding system, Bidder's attendance during the Price Bid opening in Employer's Premises is not envisaged, as the same may be observed by the respective bidders from their online login credentials of the e-tendering portal. Employer may also intimate the Techno commercial qualified bidders through mails for the opening of price bids.

27 **CONFIDENTIALITY**

Information relating to the examination, clarification, evaluation, and comparison of Bids, and recommendations for the award of a Contract, shall not be disclosed to Bidders or any other persons not officially concerned with such process. Any effort by a Bidder to influence the Employer's/ Owner's processing of Bids or award decisions may result in the rejection of the Bidder's Bid and action shall be initiated as per procedure in this regard.

28 **CONTACTING THE EMPLOYER/ OWNER**

28.1 From the time of Bid opening to the time of award of Contract, if any Bidder wishes to contact the Employer/ Owner on any matter related to the Bid, it should do so in writing. Information relating to the examination, clarification, evaluation & recommendation for award shall not be disclosed.

28.2 Any effort by the Bidder to influence the Employer/ Owner in the Employer's 'Bid Evaluation', 'Bid Comparison', or 'Contract Award' decisions may result in the rejection of the offer/Bid and action shall be initiated as per procedure in this regard.

29 **EXAMINATION OF BIDS AND DETERMINATION OF RESPONSIVENESS**

29.1 The owner's determination of a bid's responsiveness is based on the content of the bid only. Prior to the detailed evaluation of Bids, the Employer will determine whether each Bid: -

- (a) Meets the "Bid Evaluation Criteria" of the Bidding Documents;
- (b) Is accompanied by the required 'Earnest Money Deposit' and 'Tender Processing Fees', if applicable
- (c) Is substantially responsive to the requirements of the Tender Documents; and
- (d) Provides any clarification and/ or substantiation that the Employer/ Owner may require

to determine responsiveness pursuant to "ITB: Clause-29.2"

29.2 A substantially responsive Bid is one which conforms to all the terms, conditions and specifications of the Tender Documents without material deviations or reservations or omissions for this purpose employer defines the foregoing terms below: -

- a) "Deviation" is departure from the requirement specified in the tender documents.
- b) "Reservation" is the setting of limiting conditions or withholding from complete acceptance of the requirement in the tender documents.
- c) "Omission" is the failure to submit part or all of the information or documentation required in the tender document.

29.3 A material deviation, reservation or omission is one that,

- a) If accepted would,
 - i) Affect in any substantial way the scope, quality, or performance of the job as specified in tender documents.
 - ii) Limit, in any substantial way, inconsistent with the Tender Document, the Employer's rights or the bidder's obligations under the proposed Contract.
- b) If rectified, would unfairly affect the competitive position of other bidders presenting substantially responsive bids.

29.4 The Employer shall examine all aspects of the bid to confirm that all requirements have been met without any material deviation, reservation or omission.

29.5 If a Bid is not substantially responsive, it may be rejected by the Employer and may not subsequently be made responsive by correction or withdrawal of the of material deviation, reservation or omission.

30 CORRECTION OF ERRORS

30.1 If there is a discrepancy between the unit price and the total price, which is obtained by multiplying the unit price and quantity specified by the Employer, or between subtotals and the total price, the unit or subtotal price shall prevail, and the quantity and the total price shall be corrected. However, in case of items quoted without indicating any quantity or the items for which the quantities are to be estimated by the Bidder, the total price quoted against such items shall prevail. If there is a discrepancy between words and figures, the amount in words will prevail.

The prices of all such item(s) against which the Bidder has not quoted rates/ amount (viz., items left blank or against which '-' is indicated) in the Price Schedules will be deemed to have been included in other item(s).

The subtotal, total price or the total bid price to be identified in Bid Form for this purpose, irrespective of the discrepancy between the amount for the same indicated in words or figures shall be rectified in line with the procedure explained above.

The Bidder should ensure that the prices furnished in various price schedules are consistent with each other. In case of any inconsistency in the prices furnished in the specified price

schedules to be identified in Bid Form for this purpose, the Employer shall be entitled to consider the highest price for that particular line item for the purpose of evaluation and for the purpose of award of the Contract use the lowest of the prices in these schedules.

- 30.2 The amount stated in the bid will be adjusted by the Employer in accordance with the above procedure for the correction of errors. If the bidder does not accept the corrected amount of bid, its bid will be rejected.

31 CONVERSION TO SINGLE CURRENCY FOR COMPARISON OF BIDS

All bids submitted must be in the currency specified at clause 14 of ITB.

32 EVALUATION OF BIDS & E REVERSE AUCTION

Bid shall be evaluated as per evaluation criteria mentioned below on the total project cost including GST. The Employer shall only use the criteria and methodology indicated in the Tender documents. No other criteria/ methodology shall be permitted.

32.1 Evaluation of Techno - Commercial Part (First Envelope)

The Employer will carry out a detailed evaluation of the bids of the qualified bidders 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 the information supplied by the bidders, pursuant to ITB Clause 11, and other requirements in the Bidding Documents, taking into account the following factors:

- a. overall completeness and compliance with the Technical Specifications of the bid. The bid that does not meet minimum acceptable standards of completeness, consistency and detail may be rejected for non-responsiveness.
- b. compliance with the time schedule
- c. Any other relevant technical factors that the Employer/ Owner deems necessary or prudent to take into consideration.
- d. Any deviations to the commercial and contractual provisions stipulated in the Tender Documents.
- e. details furnished by the bidder in response to the requirements specified in the Tender Documents.

32.2 Opening of Second Envelope by Employer

The Second Envelope i.e., Price Part of only those Bidders shall be opened who are determined as having submitted substantially responsive bids and are ascertained to be qualified to satisfactorily perform the Contract, pursuant to ITB Clause 32.1. In case the bid/offer is rejected, pursuant to ITB Clause 32.1 the Second Envelope submitted by such bidders shall be sent to archive unopened and the EMD, if applicable shall be returned as per

the Tender provisions.

The prices and details as filled up in Electronic Form by the bidder and opened during the bid opening and recorded in the Bid Opening Statement would not be construed to determine the relative ranking amongst the Bidders, or the successful Bidder, and would not confer any right or claim whatsoever on any Bidder. The successful Bidder (also referred to as the L1 Bidder) shall be determined as per the provisions of this Section - II and considered for award of contract as provided in ITB.

32.3 Evaluation of Financial Part (Second Envelope)

32.3.1 The Employer will examine the Price Part (Second Envelopes) to determine whether they are complete, whether any computational errors have been made, whether the documents have been properly signed/digitally signed, and whether the bids are generally in order.

32.3.2 The Price Part containing any deviations and omissions from the contractual and commercial conditions and the Technical Specifications which have not been identified in the First Envelope are liable to be rejected.

32.3.3 Arithmetical errors will be rectified in line with Clause no. 30 of ITB.

32.3.5 The comparison shall also include the impact of Goods & Service Tax (GST) in line with the provisions of the Tender Documents.

32.3.6 The Employer's comparison will also include the costs resulting from application of the evaluation procedures described below:

a. The Evaluated Bid Value (EBV) shall be calculated using the following method:

- i. EPC/ LSTK Contract Value i.e., Total sum of the price comprising of Ex Works Supply of all Equipments and materials including mandatory spares and any other supplies specified in the Contract Documents, providing all services i.e. Transportation for delivery at site and Insurance including unloading, storage, handling at site, Civil works, Erection, Installation, Testing and Commissioning, performance testing in respect of all the equipment's supplied and any other services specified in the Tender Documents including Goods & Service Tax as per the Technical Scope of Work.
- ii. Net Present Value (NPV) of O&M Contract Price including GST for the entire period in years to be calculated at a discounting rate as mentioned in the Tender documents.

The exact format for sharing the base price and all Goods & Service Tax is attached in SOR 1& SOR 2.

SOR -1 is the Schedule and Breakup of Lump sum Price (Supply, Service and NPV of O&M) of the Tender. SOR -2 comprises of the yearly Breakup of the NPV of O&M price for 10 years period.

Bidder to mention the Total NPV of O&M amount for total 10 years in SOR-1 which should match with the Total NPV of O&M amount for total 10 years in SOR 2.

- b. **Evaluated Bid Value (EBV)** = (1) EPC/ LSTK Price as quoted by the bidder + (2) O & M Contract Price for the entire period in years on NPV basis.

Detailed Taxation Break up for this purpose is also given in the SOR-1 & SOR-2 of the SOR for the EBV calculation purpose.

Discounting Rate for NPV calculation considered is 8.30%

32.4 Evaluation of Price Bid

32.4.1 Following factors shall be considered for evaluation of Price Bids:

- Total Evaluated Bid Values (TEBV) for all the Bidders shall be compared to determine the lowest Total Evaluated Bid Value (TEBV) as given under SOR- 1 Format of Schedule of Rates & the lowest (L1) evaluated Bid as such, will be selected for the Notification of Award (NOA) subject to the successful bidder selected after E-Ra (Clause 32.4.2).
- The mentioned Total Evaluated Bid Value will be considered up to 2 decimal places only.
- Bidder with the Total lowest EBV shall be L-1, Bidder with Second lowest EBV shall be L-2 & so on subject to the successful bidder selected after E-Ra (Clause 32.4.2)
- The Total Evaluated Bid Value shall be inclusive of Goods & Service Tax (GST) as quoted by the bidder. The award shall be placed Inclusive of GST with taxation bifurcation separately indicated as submitted by the successful bidder in the SOR format.
- Billing Break-up (BBU):
 - The successful bidder will be mandatorily required to provide the detailed Billing break up (BBU) with GST in line with SOR 1 & 2 at the time of Award of Contract Agreement. Same will form the part of Contract Agreement (CA).
 - For each item of SOR 1 & 2, the BBU shall be prepared in the same SOR format (Item name, UoM, Quantity, unit Ex Works price, GST, Total price etc) and the sum of all billing break-up item prices shall be equivalent to the each respective SORs item price with discounted rate of e-Reverse auction (If applicable).
 - The Contractor would be required to provide detailed Bill of Quantity (BOQ) along with the break-up of Contract Price (including GST) and HSN code of the respective goods/services, which should match with the Price Quoted by the Contractor in its Price Bids and accepted by the Employer. This will be used by the Owner at the time of payment to the Contractor. Accordingly, bidders should diligently quote the GST component in the bid.
 - Owner shall reimburse the amount of GST as per the rates mentioned by Contractor in the detailed BOQ. In case of any statutory variation in GST during the currency of the Contract, same will be reimbursed to the Contractor subject to the treatment provided under clause No 13 of the ITB of the Bidding document, only in respect of the items/quantity which have been mentioned by the Contractor in the detailed BOQ.

- In case of imported Equipment/items purchased from third party (Bought-Out Items) are supplied to the Employer/Owner in execution of the Project, the price of such Goods shall be inclusive of all cost as well as any duties paid/payable in relation to import/purchase of such goods (viz., customs duties, GST & levies etc.) considering and taking into account the ITC as may be available under the applicable laws including GST.

- In case of any statutory variation in GST during the currency of the Contract, same will be reimbursed to the Contractor only in respect of the taxes which are levied during the direct transaction held between Owner and the Contractor. Any statutory variation applicable in respect of the items/services procurement between third party/sub-contractor and the Contractor would not be reimbursed by Owner. The successful bidder will be required to provide the detailed Billing break up (BBU) with GST in line with SOR's at the time of Award of Contract Agreement. Same will form the part of Contract Agreement (CA)

For First contract: In case of any clarification from the GST authorities on the interpretation of applicable GST rate during the contract period, revised GST will be considered for reimbursement of taxes and also taxes will be paid on actual basis as reported in GSTR-2A.

Bidder should invoice separately for Equipments, machinery, solar panels and any other supply of goods involved in this contract mentioning their description of goods, HSN,value etc.,

For Second contract: In case of any clarification from the GST authorities on the interpretation of applicable GST rate during the contract period, revised GST will be considered for reimbursement of taxes and also taxes will be paid on actual basis as reported in GSTR-2A.

Bidder should invoice separately for components, spare parts etc., consumed for O&M service involved in this contract mentioning their description of goods, HSN, value etc.

- f) SOR -1 is the Schedule and Breakup of Lump sum Price (Supply, Service and NPV of O&M) of the Tender. SOR -2 comprises of the yearly Breakup of the NPV of O&M price for 10 years period.

32.4.2 Procedure for e- Reverse Auction (e-RA):

1. The e-auctioning shall be conducted on <https://www.bharat-electronictender.com>. E-Auctioning shall be carried out on the day as intimated by SECI to the eligible bidders.
2. After financial bid evaluation, the bidders shall be shortlisted in the ascending order of price bid quoted. Keeping minimum 03 Bids eligible for e-RA, Total no of bids will be reduced by a factor 1/2 and resultant as such, will be eligible for e-RA. Decimal Nos will be corrected to next whole No & will be counted accordingly for the e-RA. If the price bid quoted is same for two or more bidders, then all the bidders with same price bid shall be considered of equal rank/standing in the order.

Ex: (1) No of Bids after arranging the Bids in ascending order = 3, so total No of Bids eligible for e-RA in this case = $3 \times 1/2 = 1.5$, but as the minimum 03 bids needs to be kept, so in this case 03 bids will be eligible for e-RA.

(2) No of Bids after arranging the Bids in ascending order = 7, so total No of Bids eligible for e-RA in this case = $7 \times 1/2 = 3.5 = 4$, rounding off to the next whole No. So, in this case 04 bids will be there for e-RA.

In case of substantially low response by the bidders & the total no of responsive bids to be less than 03 (Three), Owner/Employer reserves the sole discretion & all rights of proceeding/Non-proceeding with e-RA, against the management approval.

- At least one week prior to e-RA, an advance intimation regarding the date and time of the e-RA will be sent by email to all bidders whose technical & financial bids have been opened and found to be qualified. However, from this advance intimation it shall not be construed by the bidders that they have been shortlisted for e-RA. Further at least two hours before the schedule start time of e-Auctioning, a system generated email for invitation for e-Auctioning will be sent to all those bidders only who have been shortlisted based on the criteria mentioned.
- Shortlisted bidders for e-Auctioning will be able to login into the ISN website of e-auctioning 15 minutes before the start time of e-auctioning.
- At the start of e-auctioning process, the bid along with the list of short-listed bidders shall be displayed with their pseudo names as their first round bid along with the NPV value of O&M quotation per year submitted and calculated as per SoR. The auctioning shall be on both the EPC price and NPV value of the O&M quoted by the bidder.

The minimum decrement step for e-Auctioning is in the multiples of **Rs. 10, 00,000/- (INR Ten lacs only)** in EPC & NPV of O&M Price bid (Firm value of the financial proposal as the sum of individual bid value of supply, erection and civil works including GST & NPV value of O&M including GST), i.e. each decrement shall be in multiples of Rs. Rs.10, 00,000/- (INR Ten Lacs only). At the end of the e-RA, the final discount offered by the bidder, in the form of price reduction so offered on the EPC & NPV value of O&M price, shall be applied proportionately to all of the SOR Line items price (EPC Price + NPV of O&M price) quoted by the bidder initially

in the financial bid. Accordingly, the revised reduced price of all of the SOR line items of the EPC & NPV of O&M will be derived. This proportionate price reduction will be applicable on both the EPC price & NPV value of O&M price, on which the e-RA has been actually conducted.

- **While applying the price reduction obtained after e-RA, all the SOR line items of the Schedule Nos 1/ SOR 1 (DSI Price of Supply & Service or the EPC price) can be straight away reduced by applying the % reduction factor uniformly on all the line items of Schedule Nos 1/ SOR 1. Same way, the NPV value of each year line item of O&M value under Schedule No 2/SOR – 2, can also be straight away reduced by applying the % reduction factor uniformly on all the line items of Schedule No 2/SOR – 2. However, as the reduced line items so arrived will be the NPV values of each year O&M value, so for the purpose of award, absolute values of each year O&M price line item wise will then be back calculated by dividing the finally arrived (After applying % reduction factor post e-RA) yearly reduced NPV values by the respective year “Discounting Rate for NPV calculation” & thereby, the absolute value of O&M price will be calculated on yearly basis. The award will be placed on the absolute value of O&M price including GST only and not on NPV of O&M price. NPV values are considered for the purpose of price bids evaluation only.**
 - L2, L3, L4.... LN Bidders have to mandatorily apply their decrements suitably so as to beat the L1 price in the first go itself, else system will not accept their respective Bids. However, at no stage, increase in EPC & NPV of O&M price will be permissible.
 - During E- Auctioning, no revision in total price for which a bidder is considered qualified after evaluation of Technical Bid is allowed.
 - The initial auctioning period will be of one (01) hour with a provision of auto extension by eight minutes from the scheduled/ extended closing time if any fresh bid is received in last eight minutes of auctioning period or extended auctioning period. If no valid bid is received during last eight minutes of auctioning period or extended auctioning period, then the e-auctioning process will get closed.
3. Following information will be displayed in the bidder’s bidding window:
- First round EPC and NPV of O&M price as their start price initially and thereafter last quoted EPC & NPV of O&M Price.
 - The auction will be conducted on the total sum of EPC & NPV of O&M price.
 - The list of last quoted EPC & NPV of O&M price (i.e. last Bid Value) of all bidders with their Pseudo Identities and their time of quote.
4. Selection of Successful Bidders

Post E-Ra, the bidders shall be selected in the ascending order with lowest quoted Evaluated Bid value (EPC + NPV of O&M price) (being L1).

- a. The final price will be arrived by adding the EPC price and the NPV of O&M price (as a result of e-auctioning process)
- b. The bidder with lowest Evaluated Bid value (EBV) at the end of E-Auctioning will be considered L1.
- c. In case of tie in the final EBV after E-Ra, (i.e. the sum of their last quoted discounted EPC price and the NPV of O&M price), among two or more bidders being the same at the end of e-Reverse Auction, they will be considered in the chronological order of their last bid with preference to the bidder who has quoted his last bid earlier than others.
- d. In the above case, if the time of quote also become exactly same among the bidders at a tie, then the ranking among these bidders shall be done as follow:
 - The bidder who has quoted lowest Total Price in their Price BID before commencement of E-Auction shall be considered as L-1.
 - If there is also a tie among any of these bidders, then L-1 will be the bidder who has the highest average annual turnover as per the documents submitted as a part of their bid.
5. At the end of selection process, a Notification of Award (NOA) will be issued to the successful bidder (L1).
6. In all cases, SECI's decision regarding selection of bidder through E-Auctioning or even annulment of tendering process shall be final and binding on all participating bidders.

32.4.3 Other Instructions

- For further instructions, the vendor should visit the home-page of the portal <https://www.bharat-electronictender> and go to the User-Guidance Centre.
- The help information provided through 'ETS User-Guidance Centre' is available in three categories :
Users intending to Register / First-Time Users, Logged-in users of Buyer organizations, and Logged-in users of Supplier organizations. Various links (including links for User Manuals) are provided under each of the three categories.
- Important Note: It is strongly recommended that all authorized users of Supplier organizations should thoroughly peruse the information provided under the relevant links, and take appropriate action. This will prevent hiccups, and minimize teething problems during the use of ETS.

33 COMPENSATION FOR EXTENDED STAY

NOT APPLICABLE

34 PURCHASE PREFERENCE

NOT APPLICABLE

[F] - NOTIFICATION OF AWARD/ LETTER OF INTENT/ CONTRACT AGREEMENT

35 AWARD

Subject to "ITB: Clause-29", Owner will award the Contract to the successful Bidder whose Bid has been determined to be substantially responsive and has been determined as the lowest provided that bidders, is determined to be qualified to satisfactorily perform the Contract.

36 NOTIFICATION OF AWARD/ LETTER OF INTENT/ LETTER OF ALLOCATION

36.1 Prior to the expiry of 'Period of Bid Validity', Owner will notify the successful bidder in writing, in the form of "Notification of Award (NOA)"/ "Letter of Intent (LOI)"/ "Letter of Allocation (LOA)" through e-mail/ courier/ registered post, that his Bid has been accepted. The acceptance of the notification of award will constitute the formation of the Contract.

36.2 Contract Period shall commence from the date of "Notification of Award"/ "Letter of Intent"/ "Letter of Allocation" or as mentioned in the Notification of Award/ Letter of Intent/ Letter of Allocation. The "Notification of Award"/ "Letter of Intent"/ "Letter of Allocation" will constitute the formation of a Contract, until the Contract has been effected pursuant to signing of Contract as per "ITB: Clause-37".

36.3 The of "Notification of Award (NOA)"/ "Letter of Intent (LOI)"/ "Letter of Allocation (LOA)" shall be issued to successful bidder in duplicate. The successful bidder is required to return its duplicate copy duly signed and stamped on each page including all the Appendix, Annexures as a token of acceptance.

36.4 In case the successful bidder fails to acknowledge the acceptance of "Notification of Award (NOA)"/ "Letter of Intent (LOI)"/ "Letter of Allocation (LOA)" as mentioned above vide clause no. 36.3, same will be treated as a case of non-responsiveness & default and Employer/ Owner may take suitable action to get the project successfully executed.

36.5 In case of Non-responsive/Non acceptance to the NOA or CA or non-submission of timely Performance Security by the successful bidder, SECI at its sole discretion may take appropriate actions with the forfeiture of EMD, if applicable & may annul the entire Tendering process at its sole discretion.

37 SIGNING OF CONTRACT AGREEMENT

37.1 Within 30 (Thirty) days of the release of Notification of Award (NOA) by the owner, the successful Bidder/ Contractor shall be required to execute the 'Contract Agreement' with Owner on a 'non-judicial stamp paper' of appropriate value [cost of the 'stamp-paper' shall be borne by the successful Bidder/ Contractor] and of 'state' specified in Bidding Data Sheet (BDS).

37.2 In case the successful bidder fails to execute the 'Contract Agreement' as mentioned above

vide clause no. 37.1, same will be treated as a case of non-responsiveness & default and Employer/ Owner may take suitable action to get the project successfully executed. Same shall constitute sufficient grounds for the forfeiture of EMD, if applicable.

- 37.3 In case of Non-responsive/Non-acceptance to the NOA or CA or non-submission of timely Performance Security by the successful bidder, SECI at its sole discretion may take appropriate actions with the forfeiture of EMD, if applicable & may annul the entire Tendering process at its sole discretion.

38. VOID

39. PROCEDURE FOR ACTION IN CASE CORRUPT/ FRAUDULENT/ COLLUSIVE/ COERCIVE PRACTICES

- 39.1 Procedure for action in case Corrupt/ Fraudulent/ Collusive/ Coercive Practices is enclosed at Annexure-I along with this ITB document.

- 39.2 Annexure-I deliberates in detail the all consequences pertaining to clause no. 39.

39.3 **NON-APPLICABILITY OF ARBITRATION CLAUSE IN CASE OF BANNING OF VENDORS/ SUPPLIERS/ CONTRACTORS/ BIDDERS/ CONSULTANTS INDULGED IN FRAUDULENT/ COERCIVE PRACTICES**

Notwithstanding anything contained contrary in GCC and other "CONTRACT DOCUMENTS", in case it is found that the Vendors/ Suppliers/ Contractors/ Bidders/ Consultants indulged in fraudulent/ coercive practices at the time of bidding, during execution of the contract etc., and/ or on other grounds as mentioned in Employer's/ Owner's "Procedure for action in case Corrupt/ Fraudulent/ Collusive/ Coercive Practices" (Annexure-I), the contractor/ bidder shall be banned (in terms of aforesaid procedure) from the date of issuance of such order by Employer/ Owner, to such Vendors/ Suppliers/ Contractors/ Bidders/ Consultants.

The Vendor/ Supplier/ Contractor/ Bidder/ Consultant understands and agrees that in such cases where Vendor/ Supplier/ Contractor/ Bidder/ Consultant has been banned (in terms of aforesaid procedure) from the date of issuance of such order by Employer/ Owner, such decision of Employer/ Owner shall be final and binding on such Vendor/ Supplier/ Contractor/ Bidder/ Consultant and the 'Arbitration clause' in the GCC and other "CONTRACT DOCUMENTS" shall not be applicable for any consequential issue/ dispute arising in the matter.

40. PUBLIC PROCUREMENT POLICY FOR MICRO AND SMALL ENTERPRISES (MSEs)

- 40.1 As per the Public Procurement Policy for Micro and Small Enterprise (MSEs) order 2012, issued vide Gazette Notification number 503, dated 23.03.2012 by Ministry of Micro, Small and Medium Enterprise of Govt. of India, and specific to this tender, MSEs must be registered with any of the following agencies/ bodies shall be exempted from Tender Processing Fees and EMD submission, if applicable upon production of valid registration certificate.

- (i) District Industries Centre (DIC)
- (ii) National Small Industries Corporation (NSIC)
- (iii) Udyog Aadhaar Memorandum

MSEs participating in the tender must submit the certificate of registration with any one of the

above agencies. The registration certificate issued from any of the above agencies must be valid as on close date of the tender.

The MSEs, who have applied for registration or renewal of registration with any of the above agencies/ bodies, but have not obtained the valid certificate as on close date of the tender, are not eligible for exemption/ preference.

40.2 In case of JV/ Consortium, in order to avail the exemption to Tender Processing Fees and Earnest Money Deposit (EMD, if applicable), all the members of JV/ Consortium should be registered under any of the Categories mentioned under clause 40.1 above.

40.3 In case the bidder is falling under above category, the bidder shall submit the documentary evidence satisfying the same.

If the bidder does not provide the above confirmation or appropriate document or any evidence, then it will be presumed that they do not qualify for any preference admissible in the tender.

41 AHR ITEMS

NOT APPLICABLE

42 RISK OF REJECTION

Any Conditional Bid will straight away run into risk of rejection.

43 INCOME TAX & CORPORATE TAX

43.1 Income tax deduction shall be made from all payments made to the contractor as per the rules and regulations in force and in accordance with the Income Tax Act prevailing from time to time.

43.2 Corporate Tax liability, if any, shall be to the contractor's account.

43.3 TDS under GST as may be applicable shall be deducted as per law of Government of India in vogue.

43.4 MENTIONING OF PAN NO. IN INVOICE/ BILL

As per CBDT Notification No. 95/2015 dated 30.12.2015, mentioning of PAN no. is mandatory for procurement of goods/ services/ works/ consultancy services exceeding INR 2 Lacs per transaction.

Accordingly, supplier/ contractor/ service provider/ consultant should mention their PAN no. in their invoice/ bill for any transaction exceeding INR 2 Lacs. As provided in the notification, in case supplier/ contractor/ service provider/ consultant do not have PAN no., they have to submit declaration in Form 60 along with invoice/ bill for each transaction.

Payment of supplier/ contractor / service provider/ consultant shall be processed only after fulfilment of above requirement

44. SETTLEMENT OF DISPUTES BETWEEN GOVERNMENT DEPARTMENT AND ANOTHER

AND ONE GOVERNMENT DEPARTMENT AND PUBLIC ENTERPRISE AND ONE PUBLIC ENTERPRISE AND ANOTHER

In the event of any dispute or difference relating to the interpretation and application of the provisions of the contracts, such dispute or difference shall be referred by either party for Arbitration to the sole Arbitrator in the Department of Public Enterprises to be nominated by the Secretary to the Government of India in-charge of the Department of Public Enterprises. The Arbitration and Conciliation Act, 1996 shall not be applicable to arbitrator under this clause. The award of the Arbitrator shall be binding upon the parties to the dispute, provided, however, any party aggrieved by such award may make a further reference for setting aside or revision of the award to the Law Secretary, Department of Legal Affairs, Ministry of Law & Justice, Government of India. Upon such reference the dispute shall be decided by the Law Secretary or the Special Secretary/ Additional Secretary, when so authorized by the Law Secretary, whose decision shall bind the Parties finally and conclusively. The parties to the dispute will share equally the cost of arbitration as intimated by the Arbitrator.

45 DISPUTE RESOLUTION (PROVISION REGARDING APPLICABLE LAWS AND SETTLEMENT OF DISPUTES)

- 45.1 Unless otherwise specified, the matters where decision of the Engineer-in-Charge is deemed to be final and binding as provided in the Agreement and the issues/ disputes which cannot be mutually resolved within a reasonable time, all disputes shall be settled in accordance with the Conciliation Rules.
- 45.2 Any dispute(s)/ difference(s)/ issue(s) of any kind whatsoever between/ amongst the Parties arising under/ out of/ in connection with this contract shall be settled in accordance with the laid down rules.
- 45.3 In case of any dispute(s)/ difference(s)/ issue(s), a Party shall notify the other Party (ies) in writing about such a dispute(s)/ difference(s)/ issue(s) between/ amongst the Parties and that such a Party wishes to refer the dispute(s)/ difference(s)/ issue(s) to Conciliation. Such Invitation for Conciliation shall contain sufficient information as to the dispute(s)/ difference(s)/ issue(s) to enable the other Party(ies) to be fully informed as to the nature of the dispute(s)/ difference(s)/ issue(s), the amount of monetary claim, if any, and apparent cause(s) of action.
- 45.4 Conciliation proceedings commence when the other Party(ies) accept(s) the invitation to conciliate and confirmed in writing. If the other Party(ies) reject(s) the invitation, there will be no conciliation proceedings.
- 45.5 If the Party initiating conciliation does not receive a reply within thirty days from the date on which he/she sends the invitation, or within such other period of time as specified in the invitation, he/she may elect to treat this as a rejection of the invitation to conciliate. If he/she so elects, he/she shall inform the other Party(ies) accordingly.
- 45.6 Where Invitation for Conciliation has been furnished, the Parties shall attempt to settle such dispute(s) amicably under Part-III of the Indian Arbitration and Conciliation Act, 1996. It would be only after exhausting the option of Conciliation as an Alternate Dispute Resolution Mechanism that the Parties hereto shall go for Arbitration. For the purpose of this clause, the option of 'Conciliation' shall be deemed to have been exhausted, even in case of rejection of 'Conciliation' by any of the Parties.
- 45.7 The cost of Conciliation proceedings including but not limited to fees for Conciliator(s), Airfare,

Local Transport, Accommodation, cost towards conference facility etc. shall be borne by the Parties equally.

- 45.8 The Parties shall freeze claim(s) of interest, if any, and shall not claim the same during the pendency of Conciliation proceedings. The Settlement Agreement, as and when reached/agreed upon, shall be signed between the Parties and Conciliation proceedings shall stand terminated on the date of the Settlement Agreement.

===== X =====

Annexure-I

PROCEDURE FOR ACTION IN CASE CORRUPT/ FRAUDULENT/ COLLUSIVE/ COERCIVE PRACTICES

A Definitions:

- A.1 “Corrupt Practice” means the offering, giving, receiving or soliciting, directly or indirectly, anything of value to improperly influence the actions in selection process or in contract execution.
- “Corrupt Practice” also includes any omission for misrepresentation that may mislead or attempt to mislead so that financial or other benefit may be obtained or an obligation avoided.
- A.2 “Fraudulent Practice” means and include any act or omission committed by an agency or with his connivance or by his agent by misrepresenting/ submitting false documents and/ or false information or concealment of facts or to deceive in order to influence a selection process or during execution of contract/ order.
- A.3 “Collusive Practice amongst bidders (prior to or after bid submission)” means a scheme or arrangement designed to establish bid prices at artificial non-competitive levels and to deprive the Employer of the benefits of free and open competition.
- A.4 “Coercive practice” means impairing or harming or threatening to impair or harm directly or indirectly, any agency or its property to influence the improperly actions of an agency, obstruction of any investigation or auditing of a procurement process.
- A.5 “Vendor/ Supplier/ Contractor/ Consultant/ Bidder” is herein after referred as “Agency”
- A.6 “Competent Authority” shall mean the authority, who is competent to take final decision for Suspension of business dealing with an Agency/ (ies) and Banning of business dealings with Agency/ (ies) and shall be the “Committee” concerned.
- A.7 “Allied Agency” shall mean all the concerns within the sphere of effective influence of banned/ suspended agencies. In determining this, the following factors may be taken into consideration:
- (a) Whether the management is common;
 - (b) Majority interest in the management is held by the partners or directors of banned/ suspended firm.
 - (c) substantial or majority shares are owned by banned/ suspended agency and by virtue of this it has a controlling voice.
- A.8 “Investigating Agency” shall mean any department or unit of Employer/ Owner investigating into the conduct of Agency/ party and shall include the Vigilance Department of the Employer/ Owner, Central Bureau of Investigation, State Police or any other agency set up by the Central

or state government having power to investigate.

B Actions against bidder(s) indulging in corrupt /fraudulent/ collusive/ coercive practice

B.1 Irregularities noticed during the evaluation of the bids:

If it is observed during bidding process/ bids evaluation stage that a bidder has indulged in corrupt/ fraudulent/ collusive/ coercive practice, the bid of such Bidder (s) shall be rejected and its Earnest Money Deposit (EMD, if applicable) shall be forfeited.

Further, such agency shall be banned for future business with Employer/ Owner for a period specified in para B 2.2 below from the date of issue of banning order.

B.2 Irregularities noticed after award of contract

(i) During execution of contract:

If an agency, is found to have indulged in corrupt/ fraudulent/ collusive/ coercive practices, during execution of contract, the agency shall be banned for future business with Employer/ Owner for a period specified in para B 2.2 below from the date of issue of banning order.

The concerned order(s)/ contract(s) where corrupt/ fraudulent/ collusive practices are observed, shall be suspended with immediate effect by Engineer-in-Charge (EIC)/ Employer/ Owner whereby the supply/ work/ service and payment etc. will be suspended. The action shall be initiated for putting the agency on banning list.

After conclusion of process, the order(s)/ contract(s) where it is concluded that such irregularities have been committed shall be terminated and Contract Performance Security submitted by agency against such order(s)/ contract(s) shall also be forfeited. The amount that may have become due to the contractor on account of work already executed by him shall be payable to the contractor and this amount shall be subject to adjustment against any amounts due from the contractor under the terms of the contract.

No risk and cost provision will be enforced in such cases.

(ii) After execution of contract and during Defect liability period (DLP)/ Warranty/ Guarantee Period:

If an agency is found to have indulged in corrupt/ fraudulent/ collusive/ coercive practices, after execution of contract and during DLP/ Warranty/ Guarantee Period/O&M Period, the agency shall be banned for future business with Employer/ Owner for a period specified in para B 2.2 below from the date of issue of banning order.

Further, the Contract Performance Security submitted by agency against such

order(s)/ contract(s) shall be forfeited.

(iii) After expiry of Defect liability period (DLP)/ Warranty/ Guarantee Period

If an agency is found to have indulged in corrupt/ fraudulent/ collusive/ coercive practices, after expiry of Defect liability period (DLP)/ Warranty/ Guarantee Period, the agency shall be banned for future business with Employer/ Owner for a period specified in para B 2.2 below from the date of issue of banning order.

B.2.2 Period of Banning

Banning period shall be reckoned from the date of issuance of banning order and shall be for a period as may be decided by the Employer/ Owner based on specific case basis. However, minimum period of ban shall be 06 (Six) months from the date of issuance of banning order.

In exceptional cases where the act of vendor/ contractor is a threat to the National Security, the banning shall be for indefinite period.

C Effect of banning on other ongoing contracts/ tenders

- C.1 If an agency is banned , such agency shall not be considered in ongoing tenders/ future tenders.
- C.2 However, if such an agency is already executing other order(s)/ contract(s) where no corrupt/ fraudulent/ collusive/ coercive practice is found, the agency shall be allowed to continue till its completion without any further increase in scope except those incidental to original scope mentioned in the contract.
- C.3 If an agency is banned during tendering and irregularity is found in the case under process:
 - C.3.1 after issue of the enquiry/ bid/ tender but before opening of Technical bid, the bid submitted by the agency shall be ignored.
 - C.3.2 after opening Technical bid but before opening the Price bid, the Price bid of the agency shall not be opened and EMD, if applicable submitted by the agency shall be returned to the agency.
 - C.3.3 after opening of price bid, EMD, if applicable made by the agency shall be returned; the offer/Bid of the agency shall be ignored & will not be further evaluated. If the agency is put on banning list for fraud/ mis-appropriation of facts committed in the same tender/ other tender where errant agency emerges as the lowest (L1), then such tender shall also be cancelled and re-invited.

D. Procedure for Suspension of Bidder

D.1 Initiation of Suspension

Action for suspension business dealing with any agency/(ies) shall be initiated by C&P

Department when

- (i) Vigilance Department based on the fact of the case gathered during investigation by them recommend for specific immediate action against the agency.
- (ii) Vigilance Department based on the input from Investigating agency, forward for specific immediate action against the agency.
- (iii) Nonperformance of Vendor/ Supplier/ Contractor/ Consultant leading to termination of Contract/ Order.

D.2 Suspension Procedure:

- D.2.1 The order of suspension would operate initially for a period not more than six months and is to be communicated to the agency and also to Vigilance Department. Period of suspension can be extended with the approval of the Competent Authority by one month at a time with a ceiling of six months pending a conclusive decision to put the agency on banning list.
- D.2.2 During the period of suspension, no new business dealing may be held with the agency.
- D.2.3 Period of suspension shall be accounted for in the final order passed for banning of business with the agency.
- D.2.4 The decision regarding suspension of business dealings should also be communicated to the agency.
- D.2.5 If a prima-facie, case is made out that the agency is guilty on the grounds which can result in banning of business dealings, proposal for issuance of suspension order and show cause notice shall be put up to the Competent Authority. The suspension order and show cause notice must include that (i) the agency is put on suspension list and (ii) why action should not be taken for banning the agency for future business from Employer/ Owner.

The competent authority to approve the suspension will be same as that for according approval for banning.

D 3 Effect of Suspension of business:

Effect of suspension on other on-going/ future tenders will be as under:

- D.3.1 No enquiry/ bid/ tender shall be entertained from an agency as long as the name of agency appears in the Suspension List.
- D.3.2 If an agency is put on the Suspension List during tendering:
 - D.3.2.1 after issue of the enquiry/ bid/ tender but before opening of Technical bid, the bid submitted

by the agency shall be ignored.

- D.3.2.2 after opening Technical bid but before opening the Price bid, the Price bid of the agency shall not be opened and EMD, if applicable submitted by the agency shall be returned to the agency.
- D.3.3 The existing contract(s)/ order(s) under execution shall continue.
- D.3.4 Tenders invited for procurement of goods, works and services shall have provision that the bidder shall submit a undertaking to the effect that (i) neither the bidder themselves nor their allied agency/(ies) are on banning list of Employer/ Owner or the Ministry of New & Renewable Energy (ii) bidder is not banned by any Government Department/ Public Sector.

Annexure-II

ADDENDUM TO INSTRUCTIONS TO BIDDERS (INSTRUCTION FOR PARTICIPATION IN E-TENDER)

1. General

Special Instructions (for e-Tendering).

Submission of Online Bids is mandatory for this Tender.

This section contains detailed instructions regarding bid submission procedure under e-tendering system (e-tender portal). Bidders are required to read the following instructions in addition to various instructions mentioned elsewhere in the bid document for e-tendering. The instructions mentioned herein related to bid submission procedure shall supersede and shall prevail over the conditions enumerated elsewhere in the bid/ tender document.

Bidders who wish to participate in e-tenders must go through the 'instructions in respect of e-Tendering essentially covering security settings required for bidder's PC/ Laptop, uploading and checking the status of digital signature in the bidder's PC/ Laptop, obtaining unique login ID and password, re-setting the password, downloading of Tender document and uploading of Offer/ Bid etc.

2. About E-Tender Portal (Web)

Solar Energy Corporation of India Limited (SECI) has adopted a secured and user friendly e-tender system enabling bidders to Search, View, Download tender document(s) directly from the ETS Portal of M/s ElectronicTender.com (India) Pvt. Limited (<https://www.bharat-electronictender.com>) through ISN Electronic Tender Services Private Limited (referred as ISN-ETS) (referred hereunder as "E-Tender Portal") and also enables the bidders to participate and submit online prices directly in the e-tender portal or uploading of SOR/ Price Schedule (Price Bid) in note and attachment folder, as applicable, and technical bids in secured and transparent manner maintaining absolute confidentiality and security throughout the tender evaluation process and award.

3. Pre-requisite for participation in bidding process

The following are the pre-requisite for participation in e-Tendering Process:

3.1 PC/ Laptop with Windows OS, Internet Explorer

Bidder must possess a PC/ Laptop with Windows 7 professional operating system and Internet Explorer 8 or 9 for hassle free bidding. Bidder is essentially required to effect the security settings as defined in the portal.

3.2 Internet Broadband Connectivity

The Bidder must have a high-speed internet connectivity (preferably Broadband) with internet explorer to access ISN-ETS's e-Tender Portal for downloading the Tender document and uploading/ submitting the Bids.

3.3 A valid e-mail Id of the Organization/ Firm

3.4 E-Tendering is a new methodology for conducting Public Procurement in a transparent and

secured manner. Now, the Government of India has made e-tendering mandatory. Suppliers/ Vendors will be the biggest beneficiaries of this new system of procurement. For conducting electronic tendering, SECI has decided to use the portal of M/s Electronic Tender.com (India) Pvt. Limited <https://www.bharat-electronictender.com> through ISN Electronic Tender Services Private Limited (referred as ISN-ETS. This portal is based on the world's most 'secure' and 'user friendly' software from Electronic Tender®. A portal built using Electronic Tender's software is also referred to as Electronic Tender System® (ETS).

Benefits to Suppliers are outlined on the Home-page of the portal.

Tender Bidding Methodology:

Sealed Bid System

Single Stage Two Envelope

Auction

The sealed bid system would be followed by an 'e-Reverse Auction'

4. Tender Bidding Methodology under Sealed Bid System of Single Stage Two Envelop:

4.1 Broad Outline of Activities from Bidder's Perspective:

- 4.1.1 Procure a Class III Digital Signing Certificate (DSC).
- 4.1.2 Register on Electronic Tender System® (ETS)
- 4.1.3 Create Marketing Authorities (MAs), Users and assign roles on ETS. It is mandatory to create at least one MA
- 4.1.4 View Notice Inviting Tender (NIT) on ETS
- 4.1.5 For this tender -- Assign Tender Search Code (TSC) to a MA
- 4.1.6 Download Official Copy of Tender Documents from ETS Note: Official copy of Tender Documents is distinct from downloading 'Free Copy of Tender Documents'. To participate in a tender, it is mandatory to procure official copy of Tender Documents for that tender.
- 4.1.7 Clarification to Tender Documents on ETS
 - a) Query to SECI (Optional)
 - b) View response to queries posted by SECI
- 4.1.8 Bid-Submission on ETS
- 4.1.9 Respond to SECI Post-TOE queries
- 4.1.10 Participate in reverse auction if invited

For participating in this tender online, the following instructions are to be read carefully. These instructions are supplemented with more detailed guidelines on the relevant screens of the ETS.

4.2 Digital Certificates

For integrity of data and authenticity/ non-repudiation of electronic records, and to be compliant with IT Act 2000, it is necessary for each user to have a Digital Certificate (DC), also referred to as Digital Signature Certificate (DSC), of Class III, issued by a Certifying Authority (CA)

licensed by Controller of Certifying Authorities (CCA) [refer <http://www.cca.gov.in>]

4.3 Registration

To use the Electronic Tender® portal <https://www.bharat-electronictender.com>, vendors need to register on the portal. Registration of each organization is to be done by one of its senior persons who will be the main person coordinating for the e-tendering activities. In ETS terminology, this person will be referred to as the Super User (SU) of that organization. For further details, please visit the website/ portal, and click on the 'Supplier Organization' link under 'Registration' (on the Home Page), and follow further instructions as given on the site. Pay Annual Registration Fee as applicable.

After successful submission of Registration details and payment of Annual Registration Fee, please contact ISN-ETS/ ETS Helpdesk (as given below), to get your registration accepted/ activated.

Important Note:

- Interested bidders have to download official copy of the RfS/ Tender & other documents after login into the ETS Portal of ISN-ETS (<https://www.bharat-electronictender.com>). If the official copy of the documents is not downloaded from ETS Portal of ISN-ETS within the specified period of downloading of RfS/ Tender and other documents, bidder will not be able to participate in the tender.
- To minimize teething problems during the use of ETS (including the Registration process), it is recommended that the user should peruse the instructions given under 'ETS User-Guidance Centre' located on ETS Home Page, including instructions for timely registration on ETS. The instructions relating to 'Essential Computer Security Settings for Use of ETS' and 'Important Functionality Checks' should be especially taken into cognizance.

Please note that even after acceptance of your registration by the Service Provider, to respond to a tender you will also require time to complete activities related to your organization, such as creation of users, assigning roles to them, etc.

ETS Helpdesk
Phone +91-124-4229071, 4229072
E-mail support@isn-ets.com

Remarks 1000 hrs to 1800 hrs on all working days ie from Monday to Friday except Government Holidays.

5. Some Bidding Related Information for this Tender (Sealed Bid)

The bid shall be submitted by the Bidder under "Single Stage - Two Envelope" procedure of bidding. Under this procedure, the bid submitted by the Bidder in two envelopes - First Envelope (also referred to as Techno - Commercial Part) and Second Envelope (also referred to as Price Part) shall comprise of the following documents:

5.1 Offline Documents

Offline documents of the bid shall comprise of following documents/ programmed file-Attachments to be submitted in sealed envelope, as part of First Envelope. **The envelope shall bear {the name of Tender, the Tender No. and the words 'DO NOT OPEN BEFORE' (due date & time)}.**

5 MW (AC) SPV Project	Tender No <u>SECI/C&P/PMC/11/0001/2021-22</u>	ITB <u>Page 41 of 47</u>	<u>Signature of Bidder</u>
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Contact Persons Name: Mr Sandeep Kumar

- (a) Original Non-Refundable Tender Processing Fee as per clause no. 05 of ITB
- (b) Original Non-Refundable Cost of Tender Document, if applicable
- (c) 'Covering Letter' on Bidder's 'Letterhead' (in Original) clearly specifying the enclosed contents, as per 'Form F-0'
- (d) EMD, in original as per Clause 16 of ITB as per 'Form F-4A' or as prescribed.
- (f) Power of Attorney for authorized signatory in non-judicial stamp paper (as per 'Form F-24')
- (g) Copy of Board Resolution
- (h) The Pass-Phrase to decrypt the relevant Bid-Parts (for both Techno-Commercial and Financial) in separate sealed envelopes before the start date and time of the Tender Opening Event (TOE)

Bidder shall also upload the scanned copies of all the above-mentioned original documents during online Bid Submission as a part of First envelope.

"Bidder should explicitly note that no offline documents are to be submitted as a part of Second envelope".

II. Online Documents/Soft Copy

Online documents/Soft copy of the bid shall comprise of following documents to be uploaded on the ISN portal <https://www.bharat-electronictender.com> as per provisions therein.

(a) As part of First Envelope

- I. The Electronic Form of the bid for First Envelope (Techno-Commercial), as available on the ISN-ETS portal, shall be duly filled.
- II. Scanned copies of all the above-mentioned original documents during online Bid Submission as a part of First envelope and Bid Form for first envelope
- III. Certificate of Incorporation
- IV. 'Bidder's General Information', as per 'Form F-1'.
- V. 'No Deviation Confirmation', as per 'Form F-6'
- VI. 'Bidder's Declaration regarding Banning, Liquidation etc.', as per 'Form F-7'
- VII. 'Declaration on restriction on procurement from certain countries.', as per 'Form F-8'
- VIII. 'Declaration regarding the procurement of Solar Inverters & Solar Modules from class I local suppliers, as per 'Form F-12'
- IX. 'Bidders Experience as per 'Form F-13'
- X. Disclosure for ALMM compliance as per 'Form F-14'

- XI. Format of Chartered Accountant certificate for financial capability of the bidder as per 'Form F-16'
- XII. 'E-Banking Format as per 'Form F-19'
- XIII. 'Shareholding Certificate' as per 'Form F-23'
- XIV. 'Format for Cyber Security Agreement' as per 'Form F-25'
- XV. 'Undertaking regarding Site Condition' as per 'Form F-26'
- XVI. Documents in accordance with the "Qualifying Requirements (QR)" establishing the qualification
- XVII. Document showing annual turnover for the financial years as required in Qualifying Requirements (QR) such as annual reports, profit and loss account, net worth etc. along with information as sought in enclosed Format F-16
- XVIII. Tender Document. (Only First and Last Pages of Original Tender Document duly sealed and signed/ digitally signed and all pages of amendments to Tender Documents duly sealed and signed/ digitally signed by the Authorized Signatory).

5.2 (B) As part of Second Envelope

- (a) The Electronic Form of the bid for Second Envelope (Price - Part), as available on the ISN portal, shall be duly filled. "Termed as **ELECTRONIC FORM**"
- (b) Main Price Bid of financial bid comprising of SOR-1 and SOR-2 of the Price Schedule (available in Section - VIII, SOR), duly Completed, sealed and signed/ digitally signed shall be uploaded. "Termed as **MAIN BID**"

5.3 Special Note on Security and Transparency of Bids

Security related functionality has been rigorously implemented in ETS in a multidimensional manner. Starting with 'Acceptance of Registration by the Service Provider', provision for security has been made at various stages in Electronic Tender's software. Specifically, for Bid Submission, some security related aspects are outlined below:

As part of the Electronic Encrypted® functionality, the contents of both the 'Electronic Forms®' and the 'Main-Bid' are securely encrypted using a Pass-Phrase created by the Bidder himself. Unlike a 'password', a Pass-Phrase can be a multi-word sentence with spaces between words (e.g. I love this World). A Pass-Phrase is easier to remember, and more difficult to break. It is mandatory that a separate Pass-Phrase be created for each Bid-Part. This method of bid-encryption does not have the security and data-integrity related vulnerabilities which are inherent in e-tendering systems which use Public-Key of the specified officer of a Buyer organization for bid-encryption. Bid-encryption in ETS is such that the Bids cannot be decrypted before the Public Online Tender Opening Event (TOE), even if there is connivance between the concerned tender-opening officers of the Buyer organization and the personnel of e-tendering service provider.

CAUTION: All bidders must fill Electronic Form for each bid-part sincerely and carefully, and avoid any discrepancy between information given in the Electronic Form and the corresponding Main-Bid.

If any variation is noted between the price mentioned in the Electronic Form and the Main Bid (Refer Clause above for the definitions of Electronic Form and Main Bid), the

price mentioned in the Main Bid shall prevail.

In case of any discrepancy between the values mentioned in figures and in words, the value mentioned in words will prevail.

The bidder shall make sure that the Pass-Phrase to decrypt the relevant Bid-Part is submitted into the 'Time Locked Electronic Key Box (EKB)' after the deadline of Bid Submission and before the commencement of the Online TOE of Technical Bid. The process of submission of this Pass-Phrase in the 'Time Locked Electronic Key Box' is done in a secure manner by first encrypting this Pass-Phrase with the designated keys provided by the Employer.

Additionally, the bidder shall make sure that the Pass-Phrase to decrypt the relevant Bid-Part is submitted to Employer in a sealed envelope before the start date and time of the Tender Opening Event (TOE).

5.4 Other Instructions

For further instructions, the vendor should visit the home-page of the portal <https://www.bharat-electronictender.com>, and go to the User-Guidance Centre

The help information provided through 'ETS User-Guidance Centre' is available in three categories – Users intending to Register/ First-Time Users, Logged-in users of Buyer organizations, and Logged-in users of Supplier organizations. Various links (including links for User Manuals) are provided under each of the three categories.

Important Note: It is strongly recommended that all authorized users of Supplier organizations should thoroughly peruse the information provided under the relevant links, and take appropriate action. This will prevent hiccups, and minimize teething problems during the use of ETS.

5.5 Seven CRITICAL DO'S AND DON'TS FOR BIDDERS

Specifically, for Supplier organizations, the following 'Seven KEY INSTRUCTIONS for BIDDERS' must be assiduously adhered to:

1. Obtain individual Digital Signing Certificate (DSC or DC) of Class III well in advance of your tender submission deadline on ETS.
2. Register your organization on ETS well in advance of the important deadlines for your first tender on ETS viz 'Date and Time of Closure of Procurement of Tender Documents' and 'Last Date and Time of Receipt of Bids'. Please note that even after acceptance of your registration by the Service Provider, to respond to a tender you will also require time to complete activities related to your organization, such as creation of -- Marketing Authority (MA) [ie a department within the Supplier/ Bidder Organization responsible for responding to tenders], users for one or more such MAs, assigning roles to them, etc. It is mandatory to create at least one MA. This unique feature of creating an MA enhances security and accountability within the Supplier/ Bidder Organization.
3. Get your organization's concerned executives trained on ETS well in advance of your first tender submission deadline on ETS
4. For responding to any particular tender, the tender (ie its Tender Search Code or TSC) has to be assigned to an MA. Further, an 'Official Copy of Tender Documents' should be procured/ downloaded before the expiry of Date and Time of Closure of Procurement of Tender

Documents. Note: Official copy of Tender Documents is distinct from downloading 'Free Copy of Tender Documents'. Official copy of Tender Documents is the equivalent of procuring physical copy of Tender Documents with official receipt in the paper-based manual tendering system.

5. Submit your bids well in advance of tender submission deadline on ETS (There could be last minute problems due to internet timeout, breakdown, etc)
6. It is the responsibility of each bidder to remember and securely store the Pass-Phrase for each Bid-Part submitted by that bidder. The bidders are required to submit correct, valid and operative Pass-Phrase to decrypt either Technical Bid Part or Financial Bid Part in a separate sealed envelope before due date and time of submission of bid. In the event, the bids are not opened with the pass-phrase submitted by bidder, Employer may ask for re-submission/ clarification for correct pass-phrase. If bidder fails to submit correct pass-phrase immediately as requested by Employer, the Tender Processing Fee and Tender Document Fee, if applicable, shall be forfeited and bid shall not be opened, and EMD, if applicable shall be refunded. No request on this account shall be entertained by Employer/ Owner.
7. ETS will make your bid available for opening during the Online Public Tender Opening Event (TOE) 'ONLY IF' the status pertaining Overall Bid-Submission is 'COMPLETE'. For the purpose of record, the bidder can generate and save a copy of 'Final Submission Receipt'. This receipt can be generated from 'Bid-Submission Overview Page' only if the status pertaining overall Bid-Submission' is 'COMPLETE'

5.6 NOTE:

While the first three instructions mentioned above are especially relevant to first-time users of ETS, the fourth, fifth, sixth and seventh instructions are relevant at all times.

6 Content of Bid

6.1 Un-Priced Bid

The Un-Priced Bid (i.e. Part I - Technical Bid, refer ITB of tender for details) to be uploaded using Link "TECHNICAL DOCUMENT". ***Bidders are advised to not upload duly filled Schedule of Rates (SOR)/ Price Schedule (PS) at this link.***

Before the bid is uploaded, the bid comprising of all relevant documents mentioned in the tender document should be digitally signed in accordance with the Indian IT Act 2000. If any modifications are required to be made to a document thereafter the modified documents shall be again digitally signed before uploading.

Bidders are required to upload all Tender forms and supporting documents which form part of the bid/ tender in the Collaboration Folder (C-Folder) under tender document of e-tender portal.

Uploading the documents relevant to bid before the bid submission date and time is the sole responsibility of the bidder.

The complete bid (each page) shall be continuously numbered in sequence, from start till end i.e. 1, 2, 3... n. The bid shall be uploaded along with proper index and indicating page numbers against each category of documents. A sample is suggested as under:

Sub-folder in C-Folder	Documents	Page nos. (for ref.)
1. INDEX	Index	1 to a
2. TENDER DOC	Tender Document, Corrigendum etc.	a+1 to b
3. B.E.C	BEC documents (including order, completion/ execution certificate, balance sheet, etc.)	b+1 to c
4. UN-PRICED COMMERCIAL	Un-priced Commercial offer/bid	c+1 to d
5. EMD/POA	Scanned copy of EMD/POA	d+1 to e
6. FORMATS	Formats of tender duly filed-in, signed and stamped and other	e+1 to f
7. TENDER FEE	Scanned copy of Tender Fee/ Integrity Pact (I.P.)	f+1 to f
8. OTHERS	Any other document	g+1 to n

The above shall ensure that there are no missing documents and traceability of relevant section is ensured.

Note:

- Bidder may save/ store the bid documents in the PC/ Laptop before submitting the bid into in e-tender portal.
- Bidder is required to fill up the price(s)/ rate(s) strictly in the Schedule of Rate (SOR)/ Price Schedule (PS) attached with the tender.

Inadvertently, if a document is uploaded in Collaboration Folder (C Folder) by the bidders, such document can be deleted by the bidder and can be replaced by a digitally signed new/ modified document prior to due date & time.

Un-priced techno-commercial bid document should be placed in the private area earmarked in the C-folder of Tender Document in e-tender portal.

6.2 Price Bid

The Price Bid (i.e. Part II - Price Bid, refer ITB for details) to be uploaded using Link given under ISN portals & and NOT using link "TECHNICAL DOCUMENT". **Bidders are advised not to upload any other documents and same shall be ignored.** For detailed instructions, refer tender document and instructions as given above.

Employer/ Owner shall not be responsible for any failure on the part of the bidder in submission of Priced Bid.

Instructions mentioned under "PRICE BID [Online]" shall be applicable in case Bidders have been asked to quote their prices on-line directly in the ISN's e-tender portal in addition to uploading of scanned copy of SOR/ PS or only the on-line price submission in the portal, as the case may be.

7 Submission of documents

Bidders are requested to upload small sized documents preferably (upto 10 MB) at a time to facilitate easy uploading into e-tender portal. Employer/ Owner shall not be responsible in case of failure of the bidder to upload documents/ bids within specified time of tender submission.

8 Last date for submission of bids

System does not allow for submission or modification of bids beyond the deadline for bid submission. However, if the bidder for some reason intends to change the bid already entered,

he may change/ revise the same on or before the last date and time of submission. The system time displayed on ISN's e-tender webpage shall be final and binding on the bidders for all purposes pertaining to various events of the subject tender and no other time shall be taken into cognizance.

Bidders are advised in their own interest to ensure that bids are uploaded in e-tender system well before the closing date and time of bid.

9 Internet connectivity

If bidders are unable to access ISN's e-tender portal or Bid Documents, the bidders may please check whether they are using proxy to connect to internet or their PC is behind any firewall and may contact their system administrator to enable connectivity. Please note that Port SSL/ 443 should be enabled on proxy/firewall for HTTPS connectivity. Dial-up/ Broad and internet connectivity without Proxy settings is another option.

Additional DO'S AND DON'TS FOR BIDDERS Participating in e-ReverseAuction

1. Get your organization's concerned executives trained for e-Reverse Auction related processes on ETS well in advance of the start of e-Reverse Auction.
2. For responding to any particular e-Reverse Auction, the e-Reverse Auction (ie its Reverse Auction Search Code or RASC) has to be assigned to an MA.
3. It is important for each bidder to thoroughly read the 'rules and related criterion' for the e-Reverse Auction as defined by the Buyer organization.
4. If applicable for an e-Reverse Auction (such as in case of a Direct e-Reverse Auction which is not preceded by a sealed-bid stage), pay your EMD, if applicable on ETS well in advance of the start of e-Reverse Auction bidding.
5. If applicable for an e-Reverse Auction (such as in case of a Direct e-Reverse Auction which is not preceded by a sealed-bid stage), pay the Bid Processing Fee well in advance of the start of e-Reverse Auction bidding.
6. It is important to digitally-sign your 'Final bid' after the end of e-Reverse Auction bidding event.



SECTION - III

BID DATA SHEETS (BDS)

5 MW (AC) SPV Project

Tender No
SECI/C&P/PMC/11/0001/2021-
22

BDS
Page 1 of 5

Signature of
Bidder

BID DATA SHEETS (BDS)

The following bid specific data for the Plant and Equipment to be procured shall amend and/ or supplement the provisions in the Section - II, Instruction to Bidders (ITB)

Sl. No.	ITB Clause Ref. No.	Bid Data Details
1.	SCOPE OF BID (ITB 1.1)	<p>The Employer is:</p> <p>Solar Energy Corporation of India Limited, 6th Floor, Plate-B, NBCC Office Block Tower-2, East Kidwai Nagar, New Delhi-110023, India</p> <p>Kind Attn.: Executive Director (C & P) / Sr Manager (C & P) Telephone Nos.: - 0091-(0)11-71989290/71989256 Fax No.: - 0091-(0)11-71989243 E-mail: - contracts@seci.co.in</p> <p>The Owner is:</p> <p>V O Chidambaranar Port Trust Tuticorin - 628004, Tamilnadu Telephone Nos.: - 0091-(0)461-2352290 (50 Lines) Fax No.: - 0091-(0)461-2354274 E-mail: - info@vocport.gov.in</p>
2.	BIDS FROM CONSORTIUM/ JOINT VENTURE (ITB 3.0)	<p><u>Replace the existing clause by the following:</u></p> <p>Bids from Consortium/ Joint Venture are ALLOWED</p>
3.	NUMBER OF BIDS PER BIDDER (ITB 4.0)	<p><u>Replace the existing clause by the following:</u></p> <p>Bidder shall submit only 'one [01] Bid' per bidder in the Bidding Process. A Bidder who submits or participates in more than 'one [01] Bid' will cause all the proposals in which the Bidder has participated to be disqualified. A Bidder including its Parent, Affiliate or Ultimate Parent or any Group Company may submit a single bid.</p> <p>Note: In case a common Company/Companies directly or indirectly hold(s) more than 10% but less than 26% shareholding in more than one Bidder participating in the Tender, each of such Bidders will be required to submit the Disclosure as per the attached format. In all other cases, this disclosure is not required & standard forms & formats will be applicable.</p>

Sl. No.	ITB Clause Ref. No.	Bid Data Details
4.	TENDER PROCESSING FEE (NON-REFUNDABLE) (ITB 5.3)	<u>Replace the existing clause by the following:</u> The Tender Processing Fee is exempted for MSME Vendors registered under NSIC/ Udyog Aadhaar/DIC Category only.
5.	BID CURRENCIES (ITB 14)	Indian Rupees (INR)
6.	BID VALIDITY (ITB 15.1)	<u>Replace the existing clause by the following:</u> The bid validity period shall be 180 (One Hundred and Eighty Days) from the date of opening of Techno-Commercial Bid (Envelope-I).
7.	EARNEST MONEY DEPOSIT (EMD) (ITB 16)	"Not Applicable" . Only Bid Securing Declaration is to be submitted in line with the form as attached under Section VI, "Sample forms & formats"
8.	ZERO DEVIATION & REJECTION CRITERIA (ITB 19.1 & 19.2)	Clause No 19.1, Zero deviation & Clause No 19.2, Rejection Criteria should be read in conjunction to each other & both clauses points mentioned should complement each other.
9.	DEADLINE FOR SUBMISSION OF BIDS (ITB 22.2)	<u>Add following to the existing clause:</u> For hard copies of bid submission purpose, the address of the Employer is: Solar Energy Corporation of India Limited, 6th Floor, Plate-B, NBCC Office Block Tower-2, East Kidwai Nagar, New Delhi-110023, India Kind Attn.: Executive Director (C & P) / Sr Manager (C & P) Telephone Nos.: - 0091-(0)11-71989256/ 71989290 Fax No.: - 0091-(0)11-71989243 E-mail: - contracts@seci.co.in
10.	BID OPENING (ITB 26.1)	<u>Add following to the existing clause:</u> The bid opening shall take place at: Solar Energy Corporation of India Limited, 6th Floor, Plate-B, NBCC Office Block Tower-2, East Kidwai Nagar, New Delhi-110023, India

Sl. No.	ITB Clause Ref. No.	Bid Data Details
11.	AWARD (ITB 35)	<u>Replace the existing clause by the following:</u> Subject to "ITB: Clause-29", the Owner, V O Chidambaranar Port Trust, Tuticorin will award the Contract Agreement (CA) to the successful Bidder, whose Bid has been determined to be substantially responsive and has been determined as the lowest (L1) provided that bidder is determined to be qualified to satisfactorily perform the Contract Technically.
12.	NOTIFICATION OF AWARD/ LETTER OF INTENT/ LETTER OF ALLOCATION (ITB 36.1)	<u>Add following to the existing clause</u> Prior to the expiry of 'Period of Bid Validity', V O Chidambaranar Port Trust, Tuticorin will notify the successful bidder in writing, in the form of "Notification of Award (NOA)"/ "Letter of Intent (LOI)"/ "Letter of Allocation (LOA)" through e-mail/ courier/ registered post, that his Bid has been accepted. The notification of award will constitute the formation of the Contract
13.	SIGNING OF CONTRACT AGREEMENT (ITB 37.1)	<u>Add following to the existing clause</u> State of which stamp paper is required for Contract Agreement: Tamilnadu The value of stamp paper will be INR 100/-
14.	NEW CLAUSE (ITB 46)	<u>Add following new clause 46 to the ITB</u> 46. Restrictions on procurement from a Bidder of a country which shares a land border with India: 46.1. Any Bidder (including its JV partner/Consortium Member, wherever applicable) from a country which shares a land border with India will be eligible to bid in this tender only if bidder is registered with the Competent Authority which is the Registration Committee constituted by the Department for Promotion of Industry & Internal Trade (DPIIT) in line with the MoF OM No 6/18/2019-PPD dated 23.07.2020. Further the successful bidder shall not be allowed to subcontract supplies/services/works to any "Sub-contractor" under "Second Contract", from a country which shares a land border with India unless such Subcontractor is registered with the competent as mentioned above. The Contractor shall not be allowed to sub-contract works to any sub-contractor/ sub-vendor from a country which shares a land border with India unless such sub-contractor is registered with the competent

Sl. No.	ITB Clause Ref. No.	Bid Data Details
		<p>Authority. However, the same shall not be applicable for “First Contract i.e. Supply Contract”.</p> <p>However, the said requirement of registration will not apply to bidders/sub- contractors from those countries (even if sharing a land border with India) to which the Government of India has extended lines of credit or in which the Government of India is engaged in development projects. Bidders may apprise themselves of the updated lists of such countries available in the website of the Ministry of External Affairs.</p>



ANNEXURE TO BID DATA SHEET (BDS) QUALIFYING REQUIREMENTS

QUALIFYING REQUIREMENTS (QR)

Qualification of the bidder(s) will be based on their meeting the minimum eligibility criteria specified below regarding the Bidder's General Standards, Technical Experience and Financial eligibility as demonstrated by the Bidder's responses in the corresponding Bid documents. The bid can be submitted by an individual Company or by a Joint Venture/Consortium of not more than 03 (Three) companies. (Specific requirements for Joint Ventures/Consortium are given below).

1.1 GENERAL ELIGIBILITY CONDITIONS

The Bidder should be a body incorporated in India under the Companies Act, 2013 including any amendment thereto. Government owned Enterprises who are registered and incorporated in India & Limited Liability Companies engaged in the business of Power/Infrastructure are also eligible for this tender. Those companies who have been debarred/blacklisted by the Government of India or SECI for conducting business, are not eligible to participate in this tender.

It's a "Domestic Competitive Bidding" and hence no foreign bidders are eligible to participate in this tender document, either on standalone basis or as a member of JV/consortium. However, the subsidiary of a foreign company, which is registered in India under Companies Act, 2013 prior to the bid submission deadline, are eligible to participate.

Limited Liability Partnerships, Proprietorships, Partnerships, NGOs, Charitable Trusts, and Educational Societies are not allowed to participate in the bidding process (either individually or in Joint Venture/ Consortium).

The Bid Processing Fees is exempted for MSME bidders registered under NSIC/ DIC/ Udyog Aadhaar Category only. As the Proprietorships, Partnerships, NGOs, Charitable Trusts, Educational Societies in any form are not allowed to participate in the tendering process, hence any Proprietorships, Partnerships, NGOs, Charitable Trusts, Educational Societies MSME vendor will also not be eligible to participate in the bidding process (either individually or in Joint Venture/ Consortium)

1.2 TECHNICAL ELIGIBILITY CONDITIONS

Bidders can participate through any one of the below mentioned qualifying routes. The Bidder shall be considered meeting Technical Eligibility criteria either from Route I or Route II.

Route I

IA. The bidder should have experience in EPC execution of Ground mounted Solar Projects on Turnkey basis including Design, Supply (Supply of Modules & Inverters can be inclusive or exclusive in the bidder's scope in the past experience), Installation and Commissioning of Grid connected Solar PV Power Plant of cumulative Capacity not less than **3 (Three) MW** in last seven Financial years as on last date of bid submission. However, such Grid connected Solar PV Power Plant capacity must have been in satisfactory operation for at least six (06) months prior to the last date of bid submission.

5 MW (AC) SPV Project	Tender No SECI/C&P/PMC/11/0001/2021-22	ANNEXURE TO BDS Page 2 of 7	Signature of Bidder
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AND

IB. Out of the above, the bidder should have experience in EPC execution of Ground mounted Solar Projects on Turnkey basis including Design, supply (Supply of Modules & Inverters can be inclusive or exclusive in the bidder's scope in the past experience), installation & commissioning of at least **02 (Two)** Grid connected Solar PV Power Plant Projects having an individual capacity of **500 (Five Hundred) KW or above** in last seven Financial years last date of bid submission. However, such Grid connected Solar PV Power Plant capacity must have been in satisfactory operation for at least six (06) months prior to the last date of bid submission.

OR

Route II

IIA. The bidder should have experience in execution of Ground mounted Solar Projects as a Developer of Grid-connected Solar PV Power Plant(s) of cumulative Capacity not less than **3 (Three) MW** in last seven Financial years as on last date of bid submission. However, such Grid connected Solar PV Power Plant capacity must have been in satisfactory operation for at least six (06) months prior to the last date of bid submission.

AND

IIB. Out of the above, the bidder should have experience in execution of Ground mounted Solar Projects as a Developer of at least **02 (Two)** Grid connected Solar PV Power Plant Projects having an individual capacity of **500 (Five Hundred) KW or above** in last seven Financial years and till last date of bid submission. However, such Grid connected Solar PV Power Plant capacity must have been in satisfactory operation for at least six (06) months prior to the last date of bid submission.

The list of projects commissioned at least 6 months prior to the last date of Bid Submission, indicating whether the project is grid connected, along with a scanned copy of the Commissioning certificate and Work order / Contract / Agreement/LOI from the Client (or Owner) shall be submitted in support of Clause 1.2 above.

The Performance Certificate must have been issued for a minimum duration of 06 (Six) months from the date of commissioning. The Performance Certificate/Joint meter reading (JMR) reports shall have been issued by any state/ central owned agencies or state power departments or authorized representative of Power offtaker (Discom/Private Power purchaser). EPC projects with solar PV module or Inverters supplied by developer/ owner as free issue item to EPC contractor shall also be considered eligible for route 1.

1.3 FINANCIAL ELIGIBILITY CONDITIONS

The Minimum Average Annual Turnover (MAAT) of the bidder in the last three financial years (i.e. FY 2016-2017, 2017-18 and 2018-19) should be **INR 10,04,00,000/- (Indian Rupees ten crores & four lakhs only)**. **MAAT shall mean Revenue from Operations as incorporated in the profit & loss account excluding other income, e.g. sale of fixed assets.** This must be the individual Company's turnover and not that of any group of Companies. A summarized sheet of average turnover, certified by a practicing Chartered Accountant/Statutory Auditor should be compulsorily enclosed along with corresponding annual accounts.

5 MW (AC) SPV Project	Tender No SECI/C&P/PMC/11/0001/2021-22	ANNEXURE TO BDS Page 3 of 7	Signature of Bidder
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AND

The net worth for the last financial year should be positive. "Net Worth" of the Bidder shall be calculated as per the Companies Act, 2013.

AND

The bidder should have a minimum Working Capital of **INR 6,27,50,000/- (Indian Rupees six crores twenty-seven lakhs & fifty thousand only)** as per the last audited financial statement. If the bidder's working capital is inadequate, the bidder should supplement this with a letter from the bidder's bank, having net worth not less than INR 500 Crores, confirming availability of the line of credit for more than or equal **INR 6,27,50,000/- (Indian Rupees six crores twenty-seven lacs & fifty thousand only)** to meet the working Capital requirement of this particular Project.

- 1.3.1 **For participation as an EPC Bidder under Route I:** In case the bidder is a subsidiary of a holding company, financial eligibility criteria referred to in clause 1.3 above shall be of that subsidiary company only (i.e. excluding its holding company).
- 1.3.2 The Bidder will provide a copy each of audited annual report of previous three financial years for ascertaining their turnover and Net Worth for the purpose of verification.
- 1.3.3 The derivation of Net Worth" of the Bidder shall be calculated as per Company Act 2013.
- 1.3.4 Other income (as per the Companies Act, 2013 including amendment/ clarifications), shall not be considered for arriving at annual turnover.
- 1.3.5 A scanned copy of Certificate of Incorporation of the Bidder shall be furnished in the bid (through online mode).
- 1.3.6 Bidders shall furnish documentary evidence as per the prescribed format (online as well as offline), duly certified by the Authorized Signatory and the Statutory Auditor / Practicing Chartered Accountant of the Bidding Company in support of their financial eligibility.

The Bidder shall furnish the following documentary evidences along with the Bid in support of meeting of above-mentioned Financial Eligibility Criteria:

- (i) "Details of Financial capability of Bidder" as per format F-16 duly signed and stamped by a Chartered Accountant (format attached).
- (ii) Audited financial results i.e. Annual Report including Audited Balance Sheet and Profit & Loss Account Statement for immediate three preceding financial years to meet the above Financial Eligibility Criteria. In case of tenders having the submission deadline up to 30th September of the relevant financial year and audited financial results of immediate 3 preceding financial years being not available, the bidder has an option to submit the audited financial results of three years immediately prior to relevant financial year. In case the bid submission deadline is after 30th September of the relevant financial year, bidder has to compulsorily submit the audited financial results of immediately preceding three financial years.

5 MW (AC) SPV Project	Tender No <u>SECI/C&P/PMC/11/0001/2021-22</u>	ANNEXURE TO <u>BDS</u> Page 4 of 7	Signature of Bidder
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1.3.7. For participation as an EPC Bidder under Route I:

In case the bidder is a subsidiary of a holding company, financial eligibility criteria referred to in the clause above, shall be of that subsidiary company only (i.e. excluding its holding company). A job executed by a Bidder for its own plant/ projects cannot be considered as experience for the purpose of meeting the Eligibility Conditions of the tender. Also, the jobs executed for Subsidiary/ Fellow subsidiary/ Holding company will not be considered as experience for the purpose of meeting Eligibility Conditions.

1.4 JOINT VENTURE & CONSORTIUM CONDITIONS:

In case the bid is submitted by a Joint venture (JV) or Consortium of two or more companies as partners, they must meet the following requirements: -

- 1.4.1 The Lead partner/member of the JV/Consortium shall meet individually 100% of Technical Eligibility Conditions given at para 1.2 above.
- 1.4.2 There can be a maximum of 03 (Three) partners/members in a JV/Consortium. The Lead partner/member of the JV/Consortium shall meet individually not less than 50% of minimum Financial Eligibility Conditions (MAAT & Working Capital) given at para 1.3 above. However, all the JV/Consortium partners/members must meet collectively 100% Financial Eligibility Conditions given at para 1.3 above. Herein, apart from the Lead partner/member, a minimum of 25% Financial eligibility should be met individually by all other partners/members of the JV/Consortium.
- 1.4.3 In the case of a joint venture/Consortium, all members shall be jointly and severally liable for the execution of the entire Contract in accordance with the Contract terms. The JV/Consortium shall nominate the Lead partner/Member of the JV/Consortium who shall have the authority to conduct all business for and on behalf of any and all the members of the JV/Consortium during the Bidding process and, in the event the JV/Consortium is awarded the Contract, during contract execution.
- 1.4.4 A firm that is a Bidder (either individually or as a JV/Consortium member) shall not participate as a Bidder or as JV/Consortium member in more than one Bid. Such participation shall result in the disqualification of all Bids in which the firm is involved. However, this does not limit the participation of a Bidder as subcontractor in another Bid or of a firm as a subcontractor in more than one Bid.
- 1.4.5 The Bid Securing Declaration & Performance Security (In case of award) of a JV/Consortium shall be in the name of the JV/Consortium that submits the Bid. If the JV/Consortium has not been legally constituted into a legally enforceable JV/Consortium at the time of bidding, the Bid Securing Declaration shall be in the names of all the members of the JV/Consortium & not in the name of "**only lead bidder**". The Bid Securing Declaration shall be executed in the names of all the members of the JV/Consortium.
- 1.4.6 Similarly, in case of the award, the Performance Security, to be submitted by a JV/Consortium shall be in the name of the JV/Consortium that has been awarded the NOA/Contract Agreement. If the JV/Consortium has not been legally constituted into a legally enforceable

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JV/Consortium, the Performance Security shall be in the names of all the partners/members of the JV/Consortium & not in the name of “**only lead bidder**”. The Performance Security Bank Guarantee shall be executed in the names of all the partners/members of the JV/Consortium.

- 1.4.7 In the case that the Bidder is a JV/Consortium, the Bid shall be signed by the authorized representative of the Lead partner/member of the JV/Consortium on behalf of the JV/Consortium, and so as to be legally binding on all the partners/members as evidenced by a power of attorney signed by their legally authorized representatives.
- 1.4.8 The joint venture/Consortium agreement should indicate precisely the responsibility of all partners/members of JV/Consortium in respect of planning, design, manufacturing, supply, installation, commissioning and training. All members of JV/Consortium should have active participation in execution during the currency of the Contract. The composition or the constitution of the JV/Consortium shall not be varied/modified subsequently without prior approval of the Employer/Owner.
- 1.4.9 The Joint Venture/Consortium must collectively satisfy the Criteria of clauses 1.2 & 1.3 above (Routes I & II) for which purpose, the relevant figure of average annual turnover and liquid assets/ credit facilities for each of the partners of the JV/Consortium shall be added together to arrive at total eligibility of the Joint Venture/Consortium. The net worth of each Partner of JV/Consortium should be positive.
- 1.4.10 A Joint Venture (JV), may or may not be incorporated as a Registered Company.
- 1.4.11 A Joint Venture (JV), if incorporated as a Registered Company, is required to submit Bid Securing Declaration and Performance Security (In case of award) in the name of Joint Venture only.
- 1.4.12 A JV is required to submit Form of Undertaking by the JV Partners (F - 17) and Form of Power of Attorney (F - 17A) as per prescribed formats enclosed in Section - VI (Sample Forms and Formats). A Consortium is required to submit Form of Undertaking by the Consortium Partners (F - 18) and Form of Power of Attorney (F - 18A) as per prescribed formats enclosed in Section - VI (Sample Forms and Formats).
- 1.4.13 JV/ Consortium is also required to declare detailed scope of work to be executed by each partner/member of JV.
- 1.4.14 The Employer may assess the capacity and capability of the bidder, to ascertain that the bidder can successfully execute the scope of work covered under the package within stipulated completion period. This assessment shall inter-alia include (i) document verification, (ii) bidder's facilities visit, (iii) details of works executed, works in hand, anticipated in future & the balance capacity available for the present scope of work, (iv) details of plant and machinery, testing facilities, design capabilities, manpower and financial resources, (v) details of quality systems in place, (vi) past experience and performance, (vii) customer feedback, (viii) banker's feedback etc.
- 1.4.15 In order to avail the benefits of exemptions in JV/ Consortium, all the partners of JV/ Consortium must be MSME Vendors/ Developers registered under NSIC/ Udyog Aadhaar/DIC Category only.



Tender for Design, Engineering, Supply, Construction, Erection, Testing, commissioning and O&M of 5 MW (AC) Grid connected ground based SPV Project at VOCPT, Tuticorin, TN, India
Employer/Owner reserves the right to waive minor deviations if they do not materially affect the capability of the Bidder to perform the contract.



5 MW (AC) SPV Project

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ANNEXURE TO
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Signature of Bidder



SECTION - IV

GENERAL CONDITIONS OF CONTRACT (GCC)

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Preamble

This Section (Section - IV) of the Bidding Documents [named as General Conditions of Contract (GCC)] provides the performance of the Contractor, payments under the contract or matters affecting the risks, rights and obligations of the parties under the contract. This Section contains provisions that are to be used unchanged unless Section - V [named as Special Conditions of Contract (SCC)] states otherwise as any changes in GCC or any complementary information that may be needed has been shown in SCC. If there is a conflict between the provisions of Section - IV & Section - V, the provisions of Section - V shall prevail.

Bidders may note that the respective rights of the Employer/ Owner and Bidders/ Contractors shall be governed by this Tender Documents and Contracts (to be) signed between the Employer/ Owner and the Contractor for the respective package(s). The provisions of this Tender Documents shall always prevail over any other documents in case of contradiction.

Further in all matters arising out of the provisions of this Section - IV and the Section - V of the Tender Documents, the laws of the Union of India shall be the governing laws and courts of the State of the Project Owner shall have exclusive jurisdiction.

[A] DEFINITIONS

1. Definition of Terms:

- 1.1 In this **TENDER** (as here-in-after defined) the following words and expressions shall have the meanings hereby assigned to them except where the context otherwise required.
- 1.1.1 **ADJUDICATOR** means the person or persons named as such in the SCC to make a decision on or to settle any dispute or difference between the Owner and the Contractor.
- 1.1.2 **AFFILIATE** shall mean a company that either directly or indirectly
- controls or
 - is controlled by or
 - is under common control with a Bidding Company
- "Control" means ownership, directly or indirectly, of more than 50% (fifty percent) of the voting shares of such Company or right to appoint majority Directors.
- 1.1.3 **AFFECTED PARTY** means Owner or the Contractor whose performance has been affected by an event of Force Majeure
- 1.1.4 **APPLICABLE LAW** means any statute, law, regulation, ordinance, notification, rule, regulation, judgment, order, decree, bye-law, approval, directive, guideline, policy, requirement or other governmental restriction or any similar form of decision of, or determination by, or any interpretation or administration having the force of law in the Republic of India and the State Government, by any Government Authority or instrumentality thereof, whether in effect as of the date of this Contract or thereafter.
- 1.1.5 **APPROVED** shall mean approved in writing including subsequent written confirmation of previous verbal approval and "APPROVAL" means approval in writing including as aforesaid.
- 1.1.6 **APPOINTING AUTHORITY** for the purpose of arbitration shall be the any person so designated by the Owner.
- 1.1.7 **ARBITRATOR** means the person or persons appointed by agreement between the Owner and the Contractor to make a decision on or to settle any dispute or difference between the Owner and the Contractor referred to him or her by the parties.
- 1.1.8 **B.I.S.** means specifications of Bureau of Indian Standards (BIS).
- 1.1.9 **BID** means the Techno Commercial proposal together with Price Bid submitted by the Bidder along with all documents/ credentials/ attachments/ annexure etc., in response to the Tender, in accordance with the terms and conditions hereof.
- 1.1.10 **BIDDER** means Bidding Company submitting the Bid. Any reference to the Bidder includes Bidding Company including its successors, executors and permitted assigns as the context may require.
- 1.1.11 **CEA** means the Central Electricity Authority.
- 1.1.12 **CHARTERED ACCOUNTANT** means a person practicing in India or a firm whereof all the partners practicing in India as a Chartered Accountant(s) within the meaning of the Chartered Accountants Act, 1949.

- 1.1.13 **COLLABORATOR** means the firms/ corporations who has provided technological support to the manufacturer for the detailed Design/establishing production line for the specific Equipment.
- 1.1.14 **COMPANY** means a body incorporated in India under the Indian Companies Act, 1956 or Companies Act, 2013 including any amendment thereto.
- 1.1.15 **CONTRACT** shall mean the Agreement between the Owner and the Contractor for the execution of the works including therein all Contract documents.
- 1.1.16 **CONTRACTOR** means the person or the persons, Company or Corporation whose Tender has been accepted by the Employer and includes the Contractor's legal representatives his/ her successors and permitted assigns.
- 1.1.17 **CONTRACT DOCUMENTS** mean collectively the Tender Documents, Designs, Drawings, Specification, Schedule of Quantities and Rates, Notification of Award/ Letter of Intent/ Letter of Acceptance and agreed variations if any, and such other documents constituting the Tender and acceptance thereof.
- 1.1.18 **CONTRACTOR'S EQUIPMENT** means all plant, facilities, equipment, machinery, tools, apparatus, appliances or things of every kind required in or for 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.
- 1.1.19 **CONTRACT PRICE/CONTRACT VALUE/PROJECT VALUE** means the firm value of the final quoted price, as a result of e- RA (if applicable), by the successful bidder specified in its financial proposal as the sum of individual contract value of Supply & Services (Supply of goods, F&I, Design, installation, Civil Works etc) as mentioned under the different work heads specified in the financial proposal including all the applicable taxes/ Goods & Service taxes.
- 1.1.20 **CONTRACTOR'S REPRESENTATIVE** means any person nominated by the Contractor and approved by the Employer to perform the duties delegated by the Contractor.
- 1.1.21 **CONSULTANT** means Techno-Commercial experts who are the consulting engineer to the Employer/ Owner for this project.
- 1.1.22 **COMMISSIONING** means a project shall be considered commissioned if all equipment as per rated capacity, mentioned under the scope of contract, has been installed and energy has flown into grid.
- 1.1.23 **COMPLETION OF FACILITIES** means that the Facilities (or a specific part thereof where specific parts are specified in the SCC) have been completed operationally and structurally and put in a tight and clean condition, and that all work in respect of Pre-commissioning of the Facilities or such specific part thereof has been completed; and Commissioning along with Operational Acceptance has been attained as per Technical Specifications.
- 1.1.24 **CHANGE ORDER** means an order given in writing by the Engineer-in-Charge/Project Manager to effect additions to or deletion from and alteration in the works.
- 1.1.25 **DAY** means a day of 24 hours from midnight to midnight irrespective of the number of hours worked in that day.
- 1.1.26 **DEFECT LIABILITY PERIOD** in relation to scope of work means 12 (Twelve) months from the date of Operational acceptance during which the Contractor stands responsible for rectifying all defects/ rejection that may appear in the works executed by the Contractor in pursuance of the Contract and includes warranties against Manufacturing/ Fabrication/ Erection/ Construction defects covering all

materials plants, equipment, components and the like supplied by the Contractor, works executed against workmanship defects.

- 1.1.27 **DEVELOPER** means an entity who has either executed or got executed the work/ project as owner of solar projects.
- 1.1.28 **DRAWINGS** shall include maps, plans and tracings, supporting documents, specifications or prints or sketches thereof with any modifications approved in writing by the Engineer-in-Charge/Project Manager and such other drawing as may, from time to time, be furnished by the Contractor.
- 1.1.29 **EARNEST MONEY DEPOSIT (EMD)** means the unconditional and irrevocable Tender Security in the form of Demand Draft/ Banker's Cheque/ Bank Guarantee to be submitted along with the Bid by the Bidder as prescribed in the Tender document.
- 1.1.30 **EMPLOYER** means the Company/ Corporation/ Government Entity, named in the **BDS/ SCC**, who is responsible for getting the Project/Facilities implemented. The Employer may be Owner himself or an agency appointed by the Owner and shall include the legal successors or permitted assigns of the Employer.
- 1.1.31 **ENGINEER-IN-CHARGE (EIC)/PROJECT MANAGER** shall mean the person designated from time to time by the Employer and shall include those who are expressly authorized by him to act for and on his behalf for operation of this Contract.
- 1.1.32 **EFFECTIVE DATE** means the date of issuance of Notification of Award/ Letter of Intent/Letter of Award (LOA) from which the Time for Completion shall be determined or any other specific date as provided in the Notice to Proceed (NTP), in case the NTP is applicable.
- 1.1.33 **FACILITIES** mean the Plant and Equipment to be supplied and installed, as well as all the installation services including all infrastructure as mentioned in scope of works to be carried out by the Contractor under the Contract.
- 1.1.34 **FINAL ACCEPTANCE/FINAL COMPLETION** means acceptance of Facilities by the Employer at the end of one year from the date of Operational Acceptance and upon demonstration of minimum annual parameters as specified in the technical specifications and completion of works under the punch list which certifies the Contractor's fulfilment of the Contract in respect of Functional and Plant Performance Guarantees of the Facilities.
- 1.1.35 **GUARANTEE TEST(S)** means the test(s) specified in the Technical Specifications to be carried out to ascertain whether the Facilities or a specified part thereof is able to attain the Functional Guarantees specified in the Technical Specifications during/ after successful Commissioning followed by Trial - Operation.
- 1.1.36 **GOODS & SERVICE TAX (GST)** means taxes or cess levied under the Central Goods and Services Tax Act, Integrated Goods and Services Tax Act, Goods and Services Tax (Compensation to States) Act and various State/Union Territory Goods and Services Tax Laws and applicable cesses, if any under the laws in force (hereinafter referred to as relevant GST Laws) w.e.f. 01.07.2017, which shall be fully complied with by Bidders..
- 1.1.37 **IEC** means specifications of International Electro-Technical Commission.
- 1.1.38 **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 provision of marine or other similar insurance (s), inspection, expediting, site preparation works (including the provision and use of Contractor's Equipment and the supply of all structural and construction materials required), installation including civil and allied works etc., testing, pre-

commissioning, commissioning, operations, maintenance, the provision of operations and maintenance manuals, training of Employer's Personnel etc..

- 1.1.39 **MWp** means Mega-Watt Peak.
- 1.1.40 **MWh** means Mega-Watt Hour.
- 1.1.41 **kWh** shall mean Kilo-Watt-hour.
- 1.1.42 **LANGUAGE FOR DRAWINGS AND INSTRUCTION** All the drawings, titles, notes, instruction, dimensions, etc. shall be in English Language only.
- 1.1.43 **MINRE** means Ministry of New and Renewable Energy, Government of India.
- 1.1.44 **MOBILIZATION** shall mean establishment of sufficiently adequate infrastructure by the Contractor at Site comprising of construction equipment, aids, tools tackles including setting of site offices with facilities such as power, water, communication etc. establishing manpower organization comprising of Resident Engineers, Supervising Personnel and an adequate strength of skilled, semi-skilled and un-skilled workers, who with the so established infrastructure shall be in a position to commence execution of work at site(s), in accordance with the agreed Time Schedule of Completion of Work. Mobilization shall be considered to have been achieved, if the Contractor is able to establish infrastructure as per Time Schedule, where so warranted in accordance with agreed schedule of work implementation to the satisfaction of Engineer-in-Charge/Project Manager.
- 1.1.45 **NET-WORTH** shall have same meaning as defined in Company Act 2013 and Amendment, if any.
- 1.1.46 **NOTICE IN WRITING OR WRITTEN NOTICE** shall mean a notice in written, typed or printed characters sent (unless delivered personally or otherwise proved to have been received by the addressee) by Email/registered post to the latest known private or business address or registered office of the addressee and shall be deemed to have been received in the ordinary course of post it would have been delivered.
- 1.1.47 **NOTIFICATION OF AWARD (NOA)/LETTER OF INTENT (LOI)/LETTER OF AWARD (LOA)** means the official notice issued vide Letter/ E-mail by the Employer/Owner notifying the Contractor that his bid has been awarded.
- 1.1.48 **NTP** means Notice to Proceed subsequent to the placement of LOA/NOA/LOI. NTP will be issued by the owner within a maximum time frame of 90 days from the date of LOA/NOA/LOI, failing which the LOA/NOA/LO shall stand withdrawn without creating any further liability on either party. In such case EMD/PBG, as applicable submitted by the contractor shall be released.
- 1.1.49 **OPERATIONAL ACCEPTANCE** means the acceptance of the Plant Facilities (or any part of the Facilities where the Contract provides for acceptance of the Facilities in parts) by the Employer/Owner, which certifies the Contractor's fulfilment of the Contract in respect of meeting Plant Functional and Performance Guarantees of the Facilities and completion of works.
- 1.1.50 **O & M** means comprehensive Operation & Maintenance of Commissioned Project/ Work/ Facilities under the contract.
- 1.1.51 **OWNER** means the Company/ Corporation/ Government Entity, named in the **BDS/ SCC**, who has decided to set up the Facilities under his ownership at his designated location and shall include the legal successors or permitted assigns of the Owner.
- 1.1.52 **PARENT COMPANY** means a company that holds more than Fifty Percent (50%) of the paid-up equity capital directly or indirectly in the Bidding Company as the case may be.

- 1.1.53 **PLANT AND EQUIPMENT** means permanent plant, equipment, machinery, apparatus, articles and things of all kinds to be provided and incorporated in the Facilities by the Contractor under the Contract (including the spare parts to be supplied by the Contractor) but does not include Contractor's Equipment.
- 1.1.54 **PRE-COMMISSIONING** means the testing, checking and other requirements specified in the Technical Specifications that are to be carried out by the Contractor in preparation for Commissioning.
- 1.1.55 **SCC** means the Special Conditions of Contract.
- 1.1.56 **SECI** means Solar Energy Corporation of India Limited, New Delhi (A Government of India Enterprise) under MNRE.
- 1.1.57 **SITE** means the land and other places upon which the Facilities are to be installed, and such other land or places as specified in the SCC of the Contract as forming part of the Site.
- 1.1.58 **SPECIFICATION** shall mean all directions the various Technical Specifications, provisions attached and referred to the Tender Documents which pertain to the method and manner of performing the work or works to the quantities and qualities of the work or works and the materials to be furnished under the Contract for the work or works, as may be amplified or modified by the Employer or Engineer-in-Charge/Project Manager during the performance of Contract in order to provide the unforeseen conditions or in the best interests of the work or works. It shall also include the latest edition of relevant Standard Specifications including all addenda/ corrigenda published before entering into Contract.
- 1.1.59 **SUB-CONTRACTOR** 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.
- 1.1.60 **TEMPORARY WORKS** shall mean all temporary works of every kind required in or about the execution, completion or maintenance of site works.
- 1.1.61 **TENDER/TENDER DOCUMENT/ BIDDING DOCUMENT** means the entire set of documents vide which Employer invite bids for Projects/ Works/ Facilities that are submitted within a finite deadline by the Bidder.
- 1.1.62 **TIME FOR COMPLETION** means the time within which Completion of the Facilities is to be attained in accordance with the specifications, as a whole (or of a part of the Facilities where a separate Time for Completion of such part has been prescribed) as specified in the SCC of the tender document
- 1.1.63 **WEEK** means a period of any consecutive seven days.
- 1.1.64 **WORKING DAY** means any day which is not declared to be holiday or rest day by the Employer/ Owner.

[B] GENERAL INFORMATION

2. General Information

2.1.a Location of Site

The proposed location of Project site(s) is/ are defined in the Scope of work under Technical specifications & also defined under the Special conditions of contract (SCC).

5 MW (AC) SPV Project	Tender No <u>SECI/C&P/PMC/11/0001/2021-22</u>	GCC Page 11 of 78	Signature of Bidder
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2.1.b Access by Road

Contractor, if necessary, shall build other temporary access roads to the actual site of construction for his own work at his own cost. The Contractor shall be required to permit the use of the roads so constructed by him for vehicles of any other parties who may be engaged on the project site. The Contractor shall also facilitate the construction of any permanent roads should the construction thereof starts while he is engaged on this work. He shall make allowance in his Tender for any inconvenience he anticipates on such account. Non-availability of access roads, railway siding and railway wagons for the use of the Contractor shall in no case condone any delay in the execution of work nor be the cause for any claim for compensation against the Employer/ Owner.

2.2 Scope of Work

The scope of work is defined in the Section - VII, Scope of Work and Technical Specifications (TS) of the Tender document. In addition, the Contractor shall provide all necessary materials, equipment, labour etc. for the execution and maintenance of the work till completion unless otherwise mentioned in the Tender Document.

2.3 Construction Water Supply

Contractor will have to make his own arrangements for supply of water to his labour camps and for works. The water quality should be suitable for use in civil construction work. All pumping installations, pipe network and distribution system will have to be carried out by the Contractor at his own risk and cost. Alternatively, the Employer/ Owner at his discretion may endeavor to provide water to the Contractor at the Employer's/ Owner's source of supply provided the Contractor makes his own arrangement for the water meter which shall be in custody of the Employer/ Owner and other pipe networks from source of supply, so as not to interfere with the layout and progress of the other construction works. In such case, a separate accounting shall be maintained for billing purpose on monthly basis. However, the Owner does not guarantee the supply of water and this does not relieve the Contractor of his responsibility in making his own arrangement and for the timely completion of the various works as stipulated.

2.4 Construction Power Supply

2.4.1 Contractor has to arrange for the construction power supply of their own. However, subject to availability, Employer/ Owner may provide access to the nearest available point in his location for supply power at only one point, from where the Contractor will make his own arrangement for temporary distribution through a temporary energy meter (sealed by Employer/ Owner). All the works will be done as per the applicable regulations with information to the Engineer-in-Charge/Project Manager. The temporary line will be removed forthwith after the completion of work or if there is any hindrance caused to the other works due to the alignment of these lines, the Contractor will re-route or remove the temporary lines at his own cost. The Contractor at his own cost will also provide suitable electric meters, fuses, switches, etc. for purposes of payment to the Employer/ Owner which should be in the custody and control of the Employer/ Owner. The cost of power supply shall be payable to the Employer/ Owner by the Contractor. The Employer/ Owner shall not, however, guarantee the supply of electricity nor have any liability in respect thereof. No claim for compensation for any failure or short supply of electricity will be admissible.

2.4.2 It shall be the responsibility of the Contractor to provide and maintain the complete installation on the load side of the supply with due regard to safety requirement at site. All cabling, equipment, installations etc. shall comply in all respects with the latest statutory requirements and safety provisions i.e., as per the Central/ State Electricity Acts and Rules etc. The Contractor will ensure that his equipment and Electrical Wiring etc., are installed, modified, maintained by a licensed Electrician/ Supervisor.

2.4.3 At all times, IEA regulations shall be followed failing which the Employer/ Owner has a right to disconnect the power supply without any reference to the Contractor. No claim shall be entertained

for such disconnection. Power supply will be reconnected only after production of fresh certificate from authorized electrical supervisors.

- 2.4.4** The Employer/ Owner is not liable for any loss or damage to the Contractor's equipment as a result of variation in voltage or frequency or interruption in power supply or other loss to the Contractor arising therefrom.
- 2.4.5** The Contractor will have to provide and install his own lights and power meters which will be governed as per Central/ State /UT Government Electricity Rules.
- 2.4.6** In case of damage of any of the Employer's/ Owner's equipment on account of fault, intentional or unintentional on the part of the Contractor, the Employer/ Owner reserves the right to recover the cost of such damage from the Contractor's bill.

2.5 Land for Contractor's Field Office, Godown and Workshop

The Employer/ Owner will, at his own discretion and convenience and for the duration of the execution of the work make available near the site, land for construction of Contractor's Temporary Field Office, godowns, workshops and assembly yard required for the execution of the Contract. The Contractor shall at his own cost construct all these temporary buildings and provide suitable water supply and sanitary arrangement. On completion of the works undertaken by the Contractor, he shall remove all temporary works erected by him and have the Site cleaned as directed by Engineer-in-Charge/Project Manager. If the Contractor shall fail to comply with these requirements, the Employer/Owner may, at the expenses of the Contractor remove such surplus and rubbish materials and dispose off the same as he deems fit and get the site cleared as aforesaid; and Contractor shall forthwith pay the amount of all expenses so incurred and shall have no claim in respect of any such surplus materials disposed off as aforesaid. But the Employer/ Owner reserves the right to ask the Contractor any time during the pendency of the Contract to vacate the land by giving 07 (Seven) day notice on security reasons or on national interest or otherwise. The Contractor shall put up temporary structures as required by them for their office, fabrication shop and construction stores only in the area allocated to them on the project site by the Employer/ Owner or his authorized representative. No tea stalls/ canteens should be put up or allowed to be put up by any Contractor in the allotted land or complex area without written permission of the Employer/ Owner. No unauthorized buildings, constructions or structures should be put up by the Contractor anywhere on the project site. For uninterrupted fabrication work, the Contractor shall put up temporary covered structures at his cost within Area in the location allocated to them in the project site by the Employer/ Owner or his authorized representative. No person except for authorized watchman shall be allowed to stay in the plant area/ Contractor's area after completion of the day's job without prior written intimation to Engineer-in-Charge/Project Manager.

2.6 Land for Residential Accommodation

No Land shall be made available for residential accommodation for staff and labour of Contractor.

[C] ADDITIONAL GENERAL INSTRUCTIONS TO BIDDERS

3. Documents

- 3.1 Corrections and Erasures:** All correction(s) and alteration(s) in the entries of Tender document shall be signed in full by the bidder with date. No erasure or over writing is permissible.
- 3.2 Witness:** Witness and sureties shall be persons of status and property and their names, occupation and address shall be stated below their signature.
- 3.3 Details of Experience:** The bidder should furnish, along with his Tender, details of previous experience in having successfully completed in the recent past works of this nature, together with

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the names of Employers/ Owners, location of sites and value of Contract, date of commencement and completion of work, delays if any, reasons of delay and other details along with documentary evidence(s).

3.4 Liability of Government of India: It is expressly understood and agreed by and between bidder or/ Contractor and Employer/ Owner that, Employer/ Owner is entering into this agreement solely on its own behalf. In particular, it is expressly understood and agreed that the Government of India has no liabilities, obligations or rights hereunder. It is expressly understood and agreed that Employer/ Owner 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 general principles of Contract Law. 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, bidder/ Contractor hereby 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 to Government of India as to any manner, claim, cause of action or thing whatsoever arising of or under this agreement.

4. Transfer of Tender Documents

4.1 Transfer of Tender Documents purchased by one intending bidder to another is not permissible.

5. Right of Employer/Owner to Accept or Reject Tender

5.1 The right to accept the Tender will rest with the Employer/ Owner. The Employer/ Owner, however, does not bind himself to accept the lowest Tender, and reserves to itself the authority to reject any or all the Tenders received without assigning any reason whatsoever. At the option of the Employer/ Owner, the work for which the Tender had been invited, may be awarded to one Contractor or split between more than one bidders, in which case the award will be made for only that part of the work, in respect of which the bid has been accepted. The quoted rates should hold good for such eventualities. Tenders in which any of the particulars and prescribed information are missing or are incomplete in any respect and/ or the prescribed conditions are not fulfilled are liable to be rejected. The Tender containing uncalled for remarks or any additional conditions are liable to be rejected. Canvassing in connection with Tenders is strictly prohibited and Tenders submitted by the Tenderers who resort to canvassing will be liable to rejection.

6. Time Schedule & Progress Reporting

6.1 The work shall be executed strictly as per the Time Schedule specified in Section - V, Special Conditions of Contract (SCC). The period of construction given in Time Schedule includes the time required for mobilization as well as testing, rectifications if any, retesting and completion in all respects to the entire satisfaction of the Engineer-in- Charge.

6.2 A joint program of execution of the work will be prepared by the Contractor based on priority requirement of this project & submitted to the Engineer in charge. This program will take into account the time of completion mentioned above and the time allowed for the priority works by the Engineer-in- Charge.

6.3 Monthly/ Weekly construction program will be drawn up by the Engineer-in- Charge jointly with the Contractor, based on availability of work fronts and the joint construction program as per above. The Contractor shall scrupulously adhere to these targets/ programs by deploying adequate personnel, construction tools and tackles and he shall also supply himself all materials of his scope of supply in good time to achieve the targets/ programs. In all matters concerning the extent of targets set out in the weekly and monthly programs and the degree of achievements the decision of the Engineer-in- Charge will be final and binding on the Contractor.

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- 6.4 The Contractor shall monitor progress of all the activities specified in the work schedule referred in GCC above and submit the progress report to the Project Manager as per the Contract Co-ordination procedure.
- 6.6 If at any time the Contractor's actual progress falls behind the scheduled program, or it becomes apparent that it will so fall behind, the Contractor shall, at the request of the Employer or the Project Manager/ EIC, prepare and submit to the Project Manager/ EIC a revised program, taking into account the prevailing circumstances, and shall notify the Project Manager/ EIC, of the steps being taken to expedite progress so as to attain Completion of the Facilities within the Time for Completion. If any extension thereof entitled under GCC, or any extended period as may otherwise be agreed upon between the Employer and the Contractor, Contractor shall submit the revised plan for completion of Facility accordingly.

6.7 Maintenance of Records of Progress Review Meeting

The Contractor shall be required to attend all site progress review meetings organized by the 'Project Manager/ EIC' or his authorized representative. The deliberations in the meetings shall inter-alia include the program, progress of work (including details of manpower, material, tools and plants deployed by the Contractor vis-à-vis agreed schedule), inputs to be provided by Employer, delays, if any and recovery program, specific hindrances to work and work instructions by Employer. The minutes of the meetings shall be recorded with the 'Project Manager/ EIC' or his authorized representative.

7. **Conflict of Interest and Bidder's Responsibility**

- 7.1 A bidder shall not have a Conflict of Interest. All bidders found to have Conflict of Interest shall be disqualified. A bidder may be considered to have a Conflict of Interest with one or more parties in this bidding process, if:
- (a) They have a controlling partner in common; or
 - (b) They receive or have received any direct or indirect subsidy from any of them; or
 - (c) They have the same legal representative for the purposes of this bid; or
 - (d) They have a relationship with each other, directly or through common third parties, that puts them in a position to have access to information about or influence on the bid of another bidder, or influence the decision of the Employer/ Owner regarding this bidding process; or
 - (e) A bidder submits more than one bid in this bidding process, either individually [including bid submitted as an agent/ authorized representative on behalf of one or more bidders or through license - licensor route, wherever permitted as per the provision of the Qualification Requirement for the bidders in the Annexure to Bid Data Sheet (BDS)] or as a partner in a Joint Venture/ Consortium, except for alternative offers permitted under Tender. This will result in the disqualification of all such bids; or
 - (f) A bidder or any of its Affiliates participated as a consultant in the preparation of the Design or Technical Specification or Detailed Project Report (DPR) of the Plant and Installation of services*/ goods and related services** that are the subject of the bid; or
 - (g) A bidder or any of its Affiliate has been hired (or is proposed to be hired) by the Employer/ Owner as a Project Manager for the Contract

Unquote:

- * Applicable for Supply & Installation Contracts
- ** Applicable for Supply & Supply cum Supervision of Installation Contracts

- 7.2 The intending bidder shall be deemed to have visited the Site and familiarized himself before submitting the Tender. Non-familiarity with the site conditions will not be considered a reason either

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for extra claims or for not carrying out the works in strict conformity with the Drawings and Specifications or for any delay in performance.

8. Retired Government or Company Officers

- 8.1 No Engineer of Gazetted rank or other Gazetted Officer employed in Engineering or Administrative duties in an Engineering Department of the States/ UT/ Central Government or of the Employer/ Owner is allowed to work as a Contractor for a period of two years after his retirement from Government Service, or from the employment of the Employer/ Owner. The Contract, if awarded, is liable to be cancelled if either the Contractor or any of his employees is found at any time to be such a person, who has not obtained the permission of the State/ Central Government before submission of Tender, or engagement in the Contractor's service as the case may be.

9. Representatives and Field Management & Controlling

- 9.1 Project Manager / Engineer- In –Charge (EIC):

If the Project Manager/ EIC is not named in the Contract, then within seven (7) days of the Effective Date, the Employer shall appoint and notify the Contractor in writing of the name of the Project Manager/ EIC. The Employer may from time to time appoint some other person as the Project Manager/ EIC 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 reasonable care, unless unavoidable 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 Project Manager/EIC shall represent and act for the Employer at all times during the currency of the Contract.

All notices, instructions, information and other communications given by the Contractor to the Employer under the Contract shall be given to the Project Manager/ EIC, except as herein otherwise provided.

- 9.2 Contractor's Representative & Construction Manager

If the Contractor's Representative is not named in the Contract, then within seven (07) days of the Effective Date, the Contractor shall appoint the Contractor's Representative and shall request the Employer in writing. If the Employer objects to the appointment within seven (07) days giving the reason therefor, then the Contractor shall appoint a replacement within seven (07) days of such objection, and the foregoing provisions of this GCC shall apply thereto.

- 9.3 The Contractor's Representative shall represent and act for the Contractor at all times during the tenure of the Contract and shall give to the Project Manager/ EIC all the Contractor's notices, instructions, information and all other communications under the Contract.

- 9.4 All notices, instructions, information and all other communications given by the Owner/ Employer or the Project Manager/ EIC 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.

- 9.5 The Contractor shall not revoke the appointment of the Contractor's Representative without the Employer 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 Clauses.

- 9.6 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 and shall specify the powers, functions

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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 Project Manager/EIC.

- 9.7 Any act or exercise by any person of powers, functions and authorities so delegated to him or her in accordance with this GCC Clause shall be deemed to be an act or exercise by the Contractor's Representative.
- 9.8 Notwithstanding anything stated in GCC Clause 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 Co-ordination Procedure.
- 9.9 From the commencement of installation of the Facilities at the Site until Final 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.
- 9.10 The Employer may object to any Contractor's 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 in- competent or negligent, or may commit a serious breach of the Site regulations and safety.
- 9.11 If any representative or person employed by the Contractor is removed in accordance with GCC Clause above, the Contractor shall, where required, promptly appoint a replacement. The Engineer-in-Charge/Project Manager may also authorize his representatives to assist in performing his duties and functions.

9.13 Hindrance Register

The Contractor may also maintain a Hindrance Register where reasons along with documentary evidence for delay/ fault may be recorded from time to time and at the time of occurrence of the hindrance and get it duly certified by the Project Manager or his authorized representative.

10. Note to Schedule of Rates

- 10.1 The Schedule of Rates should be read in conjunction with Section - VIII of the Tender documents.
- 10.2 The bidder shall be deemed to have studied the Drawings (if any), Specifications and details of work to be done within Time Schedule and to have acquainted himself of the condition prevailing at site.
- 10.3 Rates must be filled in the Schedule of Rates of original Tender Documents. If quoted in separate typed sheets no variation in item description or specification shall be accepted.

11. Policy for Tenders under Consideration

- 11.1 Only Those Tenders which are complete in all respects and are strictly in accordance with the Terms and Conditions and Technical Specifications of Tender Document, shall be considered for evaluation. Such Tenders shall be deemed to be under consideration immediately after opening of Tender and until such time an official intimation of acceptance/ rejection of Tender is made by Employer to the Bidder.
- 11.2 Zero Deviation: Bidders to note that this is a Zero Deviation Tender. Employer will appreciate submission of bids based on the terms and conditions in the enclosed General Conditions of

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Contract (GCC), Special Conditions of Contract (SCC), Instructions to Bidders (ITB), Scope of Work, technical specifications etc. to avoid wastage of time and money in seeking clarifications on technical/ commercial aspects of the bids. Bidder may note that no technical and commercial clarifications will be sought for after the receipt of the bids. In case of any deviation/ nonconformity observed in the bid, it will be liable for rejection.

12. Clarification of Tender Document

- 12.1 Verbal clarification and information given by Employer or its representatives shall not in any way be binding on Employer.

13. Local Conditions

- 13.1 The site is being offered to the bidders for Project on “**as is where is**” basis assuming that bidders have acquainted themselves appropriately with all the local site conditions & no plea will be entertained before/after the award of contract on this ground. It will be imperative on each bidder to acquaint himself of all local site conditions and factors which may have any effect on the execution of work covered under the Tender Document. In their own interest, the bidder(s) is/ are requested to familiarize themselves with the Indian Income Tax Act 1961, Indian Companies Act 1956, and Indian Customs Act 1962, GST Act and other related Acts and Laws and Regulations of India with their latest amendments, as applicable. Employer shall not entertain any requests for clarifications from the bidder regarding such local conditions.
- 13.2 It must be understood and agreed that such factors have properly been investigated and considered while submitting the Tender. Any claim for financial or Forex or any other adjustments to Value of Contract, on lack of clarity of such factors shall not be entertained.

14. Extension of Time for Commissioning

- 14.1 The time for Project commissioning as specified in the SCC is firm & final binding till the final commissioning of the Plant facilities. The Time(s) for Commissioning specified in the SCC shall be extended if the Contractor is delayed or impeded in the Performance of any of its obligations under the Contract due to delay in fulfilment of obligations by the Owner or by the reason of any of occurrence of Force Majeure as provided in the Tender for Force Majeure.
- 14.2 The Contractor shall at all times use its reasonable efforts to minimize any delay in the Performance of its obligations under the Contract.

[D] GENERAL OBLIGATIONS

15.1 Priority of Contract Documents

Several documents forming the Contract are to be taken as mutually explanatory of one another, but in case of ambiguities or discrepancies the same shall be explained and adjusted by the Engineer-in-Charge/Project Manager who shall thereupon issue to the Contractor instructions thereon and in such event, unless otherwise provided in the Contract, the priority of the documents forming the Contract shall be as follows:

- Contract Agreement and the appendices, along with the amendments, if any thereto
- Notification of award (NoA)/Letter of Intent (LOI) /Letter of Award (LOA)/Notice to proceed (NTP)
- Special Conditions of Contract
- General Conditions of Contract
- BDS & ITB
- Special Technical Conditions on Technical Specifications
- Technical Specifications and Drawings

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- h) Price Schedules submitted by the Contractor
- i) Other completed Bidding forms submitted with the Bid
- j) Any other documents forming part of the Employer's Requirements

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 above. For eg. Contract agreement have precedence over NOA.

15.2 Headings and Marginal Notes

All headings and marginal notes to the clauses of these General Conditions of Contract or to the Specifications or to any other Tender Document are solely for the purpose of giving a concise indication and not a summary of the contents thereof, and they shall never be deemed to be part thereof or be used in the interpretation or construction thereof the Contract.

15.3 Singular and Plural

In Contract Documents unless otherwise stated specifically, the singular shall include the plural and vice versa wherever the context so requires.

15.4 Interpretation

Words implying 'Persons' shall include relevant Corporate Companies/ Registered Associations/ Body of Individuals/ Firm of Partnership' as the case may be.

16 Special Conditions of Contract (SCC)

- 16.1 Special Conditions of Contract shall be read in conjunction with the General Conditions of Contract, Specification of Work, Drawings and any other documents forming part of this Contract wherever the context so requires.
- 16.2 Notwithstanding the sub-division of the documents into these separate sections and volumes every part of each shall be deemed to be supplementary to and complementary of every other part and shall be read with and into the Contract so far as it may be practicable to do so.
- 16.3 Where any portion of the General Condition of Contract is repugnant to or at variance with any provisions of the Special Conditions of Contract, unless a different intention appears the provisions of the Special Conditions of Contract shall be deemed to over-ride the provisions of the General Conditions of Contract and shall to the extent of such repugnancy, or variations, prevail.
- 16.4 Wherever it is mentioned in the specifications that the Contractor shall perform certain Work or provide certain facilities, it is understood that the Contractor shall do so at his cost and the Value of Contract shall be deemed to have included cost of such performance and provisions, so mentioned.
- 16.5 The materials, design and workmanship shall satisfy the relevant Indian Standards, the Job Specifications contained herein and Codes referred to. Where the job specification stipulate requirements in addition to those contained in the standard codes and specifications, these additional requirements shall also be satisfied.
- 17 **Contractor to obtain his own Information**
 - 17.1 The Contractor in fixing his cost shall for all purpose whatsoever reason may be, deemed to have himself independently obtained all necessary information for the purpose of preparing his tender and his tender as accepted shall be deemed to have taken into account all contingencies as may arise due to such information or lack of same. The correctness of the details, given in the Tender

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Document to help the Contractor to make up the tender is not guaranteed. The Contractor shall be deemed to have examined the Contract Documents, to have generally obtained his own information in all matters whatsoever that might affect the carrying out of the works at the scheduled rates and to have satisfied himself to the sufficiency of his offer.

Any error in description of quantity or omission therefrom shall not vitiate the Contract or release the Contractor from executing the work comprised in the Contract according to Drawings and Specifications at the scheduled rates. He is deemed to have known the scope, nature and magnitude of the Works and the requirements of materials and labour involved etc., and as to what all works he has to complete in accordance with the Contract documents whatever be the defects, omissions or errors that may be found in the Documents. The Contractor shall be deemed to have visited surroundings, to have satisfied himself to the nature of all existing structures, if any, and also as to the nature and the conditions of the Railways, Roads, Bridges and Culverts, means of transport and communication, whether by land, water or air, and as to possible interruptions thereto and the access and egress from the site, to have made enquiries, examined and satisfied himself as to the sites for obtaining sand, stones, bricks and other materials, the sites for disposal of surplus materials, the available accommodation as to whatever required, depots and such other buildings as may be necessary for executing and completing the works, to have made local independent enquiries as to the sub-soil, subsoil water and variations thereof, storms, prevailing winds, climatic conditions and all other similar matters effecting these works.

He is deemed to have acquainted himself as to his liability of payment of Government Taxes, duties and other charges, levies etc. Any neglect or omission or failure on the part of the Contractor in obtaining necessary and reliable information upon the foregoing or any other matters affecting the Contract shall not relieve him from any risks or liabilities or the entire responsibility from completion of the works at the scheduled rates and times in strict accordance with the Contract. It is, therefore, expected that should the Contractor have any doubt as to the meaning of any portion of the tender Document he shall set forth the particulars thereof in writing to Employer before bid submission.

The Employer may provide such clarification as may be necessary in writing to Contract, such clarifications as provided by Employer shall form part of tender Documents. No verbal agreement or inference from conversation with any effect or employee of the Employer either before, during or after the execution of the Contract Agreement shall in any way affect or modify and of the terms or obligations herein contained. Any change in layout due to site conditions or technological requirement shall be binding on the Contractor and no extra claim on this account shall be entertained.

18 Time of Performance

18.1 Time for Mobilization

The work covered by this Tender shall be commenced immediately upon issuance of the NOA/ LOI/LOA/NTP (whichever is later) and be completed on or before the dates as mentioned in the Time Schedule of Completion of Work under Section - V, Special Conditions of Contract (SCC). The Contractor should bear in mind that time is the essence of this contract agreement. Request for revision of construction time after tenders are submitted will not receive any consideration. The mobilization period is included within the overall Completion Schedule, not over and above the completion time to any additional work or any other reasons.

18.2 Time Schedule of Construction

- 18.2.1 The general time schedule of construction is given in the Section - V, Special Conditions of Contract (SCC) of the Tender Documents. Contractor should prepare a detailed monthly or weekly construction program. The Work shall be executed strictly as per the Time Schedule given in the Tender Documents. The period of construction given includes the time required for mobilization

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testing, rectifications, if any, retesting and completion in all respects in accordance with Contract Document.

18.2.2 The Contractor shall submit a detailed Bar chart in MS Projects consisting of adequate number of activities covering various key phases of the Work such as Design, Procurement, Manufacturing, Shipment and Field Erection activities. This network shall also indicate the intermediate milestones and interface facilities to be provided by the Employer, if any and the dates by which such facilities are needed.

19. Force Majeure

19.1 A 'Force Majeure' means any event or circumstance or combination of events those stated below that wholly or partly prevents or unavoidably delays an Affected Party in the performance of its obligations under this Agreement, but only if and to the extent that such events or circumstances are not within the reasonable control, directly or indirectly, of the Affected Party and could not have been avoided if the Affected Party had taken reasonable care or complied with Prudent Utility Practices:

- Act of God, including, but not limited to lightning, fire not caused by Contractors' negligence and explosion (to the extent originating from a source external to the site), earthquake (above 7.0 magnitude on Richter Scale), volcanic eruption, landslide, unprecedented flood, cyclone, typhoon or tornado;
- Any act of war (whether declared or undeclared), invasion, armed conflict or act of foreign enemy, blockade, embargo, revolution, riot, insurrection, terrorist or military action, quarantine;
- Radioactive contamination or ionizing radiation originating from a source in India or resulting from another Force Majeure Event mentioned above.

19.2 Force Majeure Exclusions

Force Majeure shall not include (i) any event or circumstance which is within the reasonable control of the Parties and (ii) the following conditions, except to the extent that they are consequences of an event of Force Majeure:

- Unavailability, late delivery, or changes in cost of the plant, machinery, equipment, materials, spare parts or consumables for the Power Project;
- Delay in the performance of any Contractor, sub-Contractor or their agents;
- Non-performance resulting from normal wear and tear typically experienced in power generation materials and equipment;
- Strikes at the facilities of the Contractor / Affected Party;
- Insufficiency of finances or funds or the agreement becoming onerous to perform; and
- Non-performance caused by, or connected with, the Affected Party's:
 - o Negligent or intentional acts, errors or omissions;
 - o Failure to comply with an Indian Law; or
 - o Breach of, or default under this Contract Agreement.
- Normal rainy seasons and monsoon
- Any Transport strikes not directly affecting the delivery of goods from manufacturer to site

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

19.4 Upon occurrence of such causes, the party alleging that it has been rendered unable as aforesaid, thereby, shall notify the other party in writing by registered notice within 48 (forty eight) hours of the

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alleged beginning thereof giving full particulars and satisfactory evidence in support of its claim. Further, within 7 (seven) days, the Contractor will furnish a detailed Contingency Plan to overcome the effects of the incident and bring the project on its schedule after cessation of the effect of Force Majeure.

- 19.5 The Affected Party shall give notice to the other Party of (i) the cessation of the relevant event of Force Majeure; and (ii) the cessation of the effects of such event of Force Majeure on the performance of its rights or obligations under this Agreement, as soon as practicable after becoming aware of each of these cessations.
- 19.6 Time for Performance of the relative obligation suspended by the force majeure shall stand extended by the period for which such Force Majeure clause lasts.
- 19.7 If works are suspended by Force Majeure conditions lasting for more than two months, the Employer/Owner shall have the option of cancelling this Contract in whole or part thereof, at its discretion.
- 19.8 The Contractor will not be entitled to claim any compensation for Force Majeure conditions and shall take appropriate steps to insure its men and materials utilized by it under the Contract.

20. Liquidated Damages (LD)

- 20.1 Subject to Force Majeure Clause, if the Contractor fails to comply with the Time for Completion /successful commissioning or any extension thereof of Plant facilities in accordance with timelines as mentioned under the SCC, then the Contractor shall pay to the Owner a sum equivalent to half percent (0.5%) per week of the Contract Price for the whole of the facilities as liquidated damages for such default and not as a penalty, without prejudice to the Owner's other remedies under the Contract subject to the maximum limit of five percent (05%) of Contract Price for the whole of the facilities. The Owner may, without prejudice to any other method of recovery, deduct the amount of such damages from any amount due or to become due to the Contractor. The payment or deduction of such damages shall not relieve the Contractor from his obligation to complete the Works, or from any other of his obligations and liabilities under the Contract. Once the maximum limit is reached, Owner may consider the termination of contract and/or shall have the discretion of getting executed the work from the Contractor with the maximum limit of Liquidated damages. Any such recovery on account of the Liquidated damages can be done from the running bills of the Contractor by Owner.
- 20.2 The Owner shall at its sole discretion upon reaching the maximum LD limit , as an alternative to the Liquidated Damages at its option, get work executed from elsewhere at the risk and cost of the Contractor irrespective of the fact whether the scope of Contract is identical to the original scope of Contract and in case the Owner chooses the alternative course as mentioned, it will be entitled to recover compensation/ damages from the Contractor irrespective of maximum limit prescribed under Clause 20.1.
- 20.3 The Owner may by giving (01) one-month notice to the Contractor cancel the Contract without prejudice to the Owner's right under Clauses 20.1 and 20.2 or any other provisions contained in the Contract to determine the Contract and claim damages from the Contractor.

21. Rights of the Owner to forfeit Contract Performance Security

- 21.1 Whenever any claim against the Contractor for the payment of a sum of money arises out of or under the Contract, the Contractor shall pay to the Owner on demand any balance remaining due to the Owner & Owner shall be entitled to recover such sum by appropriating in part or whole from the Contract Performance Security of the Contractor. In the event of the security being insufficient or if no security has been taken from the Contractor, then the balance or the total sum recoverable, as

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the case may be shall be deducted from any sum then due or which at any time thereafter may become due to the Contractor.

22. Failure by the Contractor to comply with the provisions of the Contract

22.1 If the Contractor refuses or fails to execute the Work or any separate part thereof with such diligence as will ensure its completion within the time specified in the Contract/O&M Contract or extension thereof or fails to perform any of his obligation under the Contract/O&M Contract or in any manner commits a breach of any of the provisions of the Contract/O&M Contract it shall be open to the Employer/ Owner at its option by written notice to the Contractor:

a) To determine the event in which the Contract/O&M Contract shall stand terminated and shall cease to be in force and effect on and from the date appointed by the Owner on that behalf, whereupon the Contractor shall stop forthwith any of the Contractor's work then in progress, except such work as the Owner may, in writing, require to be done to safeguard any property or work, or installations from damage..

22.2 In such events of Clause 22.1(a)above.

a) The whole or part of the Contract Performance Security furnished by the Contractor is liable to be forfeited without prejudice to the right of the Owner to recover from the Contractor the excess cost referred to in the Clause aforesaid, the Owner shall also have the right of taking possession and utilizing in completing the works or any part thereof, such as materials, equipment and plants available at work site belonging to the Contractor as may be necessary and the Contractor shall not be entitled for any compensation for use or damage to such materials, equipment and plant.

22.3 Before determining the Contract as per Clause 22.1(a)provided in the judgement of the Owner, the default or defaults committed by the Contractor is/ are curable and can be cured by the Contractor if an opportunity given to him, then the Owner may issue Notice in writing calling the Contractor to cure the default within such time specified in the Notice.

22.4 The Owner shall also have the right to proceed or take action as per 22.1(a)above, in the event that the Contractor becomes bankrupt, insolvent, compounds with his creditors, assigns the Contract in favor of his creditors or any other person or persons, or being a company or a corporation goes into voluntary liquidation, provided that in the said events it shall be necessary for the Owner to give prior notice to the Contractor. Refer clause 25 below for further details on the "termination" of contract pertaining to various contractual situations.

23. Contractor remains liable to pay compensation if

23.1 In any case in which any of the powers conferred upon the Owner by Clause 22.0 thereof shall have become action not taken under clause 22 exercisable and the same had not been exercised, the non-exercise thereof shall not constitute a waiver of any of the conditions hereof and such powers shall notwithstanding be exercisable in the event of any further case of default by the Contractor for which by any clause or clauses hereof he is declared liable to pay compensation amounting to the whole of his Contract Performance Security, and the liability of the Contractor for past and future compensation shall remain unaffected.

24. Contract Performance Security

Against the EPC/ LSTK Contract and Operation & maintenance contract of the project, within 30 (Thirty) days from the issuance of the Notification of Award/ Letter of Intent/Letter of Award (LOA) from Owner, the successful bidder shall furnish an unconditional and irrevocable Contract Performance Security in accordance with Special Conditions of the Contract. The Contract Performance Security shall be in the form of either Banker's Cheque or Demand Draft

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or Bank Guarantee and shall be in the currency of the Contract and will be issued in the name of the Owner as specified in the BDS/SCC. The Contract Performance Security shall be for an amount equal to specified in Special Conditions of Contract (SCC) towards faithful performance of the contractual obligations, performance of equipment and shall cover entire Contract. The validity of Contract Performance Security shall be in conjunction with the provisions mentioned under Section - V, Special Conditions of Contract (SCC).

Bank Guarantee towards Contract Performance Security shall be from any scheduled bank as specified in the List of Banks enclosed at Form F-22, Section - VI, Sample Forms and Formats of Tender documents or a branch of an International Bank situated in India and registered with Reserve Bank of India as scheduled foreign bank in case of Indian bidder. However, in case of Bank Guarantees from Banks other than the Nationalized Indian banks, the Bank must be a commercial Bank having net worth in excess of INR 500 Crores and a declaration to this effect should be made by such commercial bank either in the Bank Guarantee itself or separately on its letterhead. This Bank Guarantee shall be valid for a period in conjunction with the provisions mentioned under Section - V, Special Conditions of Contract (SCC).

The Contract Performance Security may also be submitted in the form of 'crossed payee accounts only' Demand Draft/ Banker's Cheque in favor of as mentioned in the BDS/SCC.

In case of default or failure of the successful bidder to comply with the requirements of this article shall constitute sufficient grounds for the cancellation of the award and forfeiture of the EMD, if applicable.

In case of default or failure of the Contractor to comply with the requirements of any of the Obligations covered under this Tender Document and/ or Contract Agreement shall constitute sufficient grounds for forfeiture of the Contract Performance Security.

The Contract Performance Security has to cover the entire contract value including extra works/ services also. As long as the Contract Performance Security submitted at the time of award takes care of the extra works/ services executed and total executed value are within the awarded contract price, there is no need for additional Contract Performance Security. As soon as the total executed value exceeds the ceiling of awarded contract price by more than 0.5%, the Contractor shall furnish additional Contract Performance Security on proportionate basis of the percentage as defined in the Special Conditions of Contract (SCC) for the additional amount in excess to the original contract value.

Further, any delay beyond 30 (Thirty) days shall attract interest @ 1.25% per month on the total Contract Performance Security amount, calculated on pro-rata basis accordingly. Owner at its sole discretion may cancel the NOA/ LOI/LOA & forfeit 100% of EMD if applicable, in case Contract Performance Security is not submitted within 45 (Forty-five) days from issuance of NOA/ LOI/LOA. However, total project completion period shall remain same. Part Security shall not be accepted. The Zero Date shall be counted from the date of LOA or NTP whichever is later.

If the Contractor/ Sub-Contractor or their employees or the Contractor's agents and representatives shall damage, break, deface or destroy any property belonging to the Employer or others during the execution of the Contract, the same shall be made good by the Contractor at his own expenses and in default thereof, the Engineer-in-Charge may cause the same to be made good by other agencies and recover expenses from the Contractor (for which the certificate of the Engineer-in-Charge shall be final).

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All compensation or other sums of money payable by the Contractor to the Owner under terms of this Contract may be deducted from or paid by the encashment of a sufficient part of his Contract Performance Security or from any sums which may be due or may become due to the Contractor by the Owner of any account whatsoever and in the event of his Contract Performance Security being reduced by reasons of any such deductions or sale of aforesaid, the Contractor shall within 10 (Ten) days thereafter make good in cash, bank drafts as aforesaid any sum or sums which may have been deducted from or realized by encashment of his Contract Performance Security, or any part thereof. No interest shall be payable by the Owner for sum deposited as Contract Performance Security.

25. Termination of contract

25.1 Termination for Owner's Convenience

25.1.1 The Owner 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 25.1.

25.1.2 Upon receipt of the notice of termination under GCC Sub-Clause 25.1.1, 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 Owner 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 Owner 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, and
- (d) subject to the payment specified in GCC Sub-Clause 25.1.3,
 - (i) deliver to the Owner the parts of the Facilities executed by the Contractor up to the date of termination
 - (ii) to the extent legally possible, assign to the Owner all right, title and benefit of the Contractor to the Facilities and to the Plant as of the date of termination, and, as may be required by the Owner, in any subcontracts concluded between the Contractor and its Subcontractors; and
 - (iii) deliver to the Owner 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.

25.1.3 In the event of termination of the Contract under GCC Sub-Clause 25.1.1, the Owner 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

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- (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 25.1.2
- (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.

25.2 Termination for Contractor's Default

25.2.1 Neither the Employer nor the Contractor may assign the Contract or any part thereof, or any right, benefit, obligation, or interest therein or thereunder, to any third party without the express prior written consent of the other Party, which consent shall not be unreasonably withheld, except that the Contractor shall be entitled to assign any monies due and payable to it or that may become due and payable to it under the Contract, either absolutely or by way of charge.

25.2.2 The Owner, 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 25.2:

- (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 25.2.1.
- (c) if the Contractor, in the judgment of the Owner has engaged in Fraud and Corruption in competing for or in executing the Contract.

25.2.3 If the Contractor

- (a) has abandoned or repudiated the Contract
- (b) has without valid reason failed to commence work on the Facilities promptly or has suspended the progress of Contract performance for more than twenty-eight (28) days after receiving a written instruction from the Owner to proceed
- (c) persistently fails to execute the Contract in accordance with the Contract or persistently neglects to carry out its obligations under the Contract without just cause
- (d) refuses or is unable to provide sufficient materials, services or labor to execute and complete the Facilities in the manner specified in the program at rates of progress that give reasonable assurance to the Owner that the Contractor can attain Completion of the Facilities by the Time for Completion as extended,

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then the Owner 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 Owner may terminate the Contract forthwith by giving a notice of termination to the Contractor that refers to this GCC Sub-Clause 25.2.

25.2.4 Upon receipt of the notice of termination under GCC Sub-Clauses 25.2.2 or 25.2.3, 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 Owner 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 Owner pursuant to paragraph (d) below
- (c) deliver to the Owner the parts of the Facilities executed by the Contractor up to the date of termination
- (d) to the extent legally possible, assign to the Owner all right, title and benefit of the Contractor to the Facilities and to the Plant as of the date of termination, and, as may be required by the Owner, in any subcontracts concluded between the Contractor and its Subcontractors
- (e) deliver to the Owner all drawings, specifications and other documents prepared by the Contractor or its Subcontractors as of the date of termination in connection with the Facilities.

25.2.5 The Owner may enter upon the Site, expel the Contractor, and complete the Facilities itself or by employing any third Party. The Owner 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 Owner and with an indemnification by the Owner for all liability including damage or injury to persons arising out of the Owner'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 Owner considers expedient for the supply and installation of the Facilities.

Upon completion of the Facilities or at such earlier date as the Owner thinks appropriate, the Owner 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.

25.2.6 Subject to GCC Sub-Clause 25.2.7, the Contractor shall be entitled to be paid the Contract Price attributable to the Facilities executed as of the date of termination, the value of any unused or partially used Plant 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 25.2.4. Any sums due the Owner 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.

25.2.7 If the Owner completes the Facilities, the cost of completing the Facilities by the Owner shall be determined.

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If the sum that the Contractor is entitled to be paid, pursuant to GCC Sub-Clause 25.2.6, plus the reasonable costs incurred by the Owner 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 25.2.6, the Contractor shall pay the balance to the Owner, and if such excess is less than the sums due the Contractor under GCC Sub-Clause 25.2.6, the Owner shall pay the balance to the Contractor.

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

25.3 Termination by the Contractor

25.3.1 If

- (a) the Owner 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, or commits a substantial breach of the Contract, the Contractor may give a notice to the Owner that requires payment of such sum, with interest, requires approval of such invoice or supporting documents, or specifies the breach and requires the Owner to remedy the same, as the case may be. If the Owner 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 fourteen (14) days after receipt of the Contractor's notice, or
- (b) the Contractor is unable to carry out any of its obligations under the Contract for any reason attributable to the Owner, including but not limited to the Owner's failure to provide possession of or access to the Site or other areas or failure to obtain any governmental permit necessary for the execution and/or completion of the Facilities,

then the Contractor may give a notice to the Owner thereof, and if the Owner 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 Owner within twenty-eight (28) days of the said notice, the Contractor may by a further notice to the Owner referring to this GCC Sub-Clause 25.3.1, forthwith terminate the Contract.

25.3.2 The Contractor may terminate the Contract forthwith by giving a notice to the Owner to that effect, referring to this GCC Sub-Clause 25.3.2, if the Owner 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 Owner takes or suffers any other analogous action in consequence of debt.

25.3.3 If the Contract is terminated under GCC Sub-Clauses 25.3.1 or 25.3.2, 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 Owner pursuant to paragraph (d) (ii)

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- (c) remove all Contractor's Equipment from the Site and repatriate the Contractor's and its Subcontractors' personnel from the Site, and
- (d) subject to the payment specified in GCC Sub-Clause 25.3.4,
 - (i) deliver to the Owner the parts of the Facilities executed by the Contractor up to the date of termination
 - (ii) to the extent legally possible, assign to the Owner all right, title and benefit of the Contractor to the Facilities and to the Plant as of the date of termination, and, as may be required by the Owner, in any subcontracts concluded between the Contractor and its Subcontractors, and
 - (iii) deliver to the Owner all drawings, specifications and other documents prepared by the Contractor or its Subcontractors as of the date of termination in connection with the Facilities.

25.3.4 If the Contract is terminated under GCC Sub-Clauses 25.3.1 or 25.3.2, the Owner shall pay to the Contractor all payments specified in GCC Sub-Clause 25.1.3, and reasonable compensation for all loss, except for loss of profit, or damage sustained by the Contractor arising out of, in connection with or in consequence of such termination.

25.3.5 Termination by the Contractor pursuant to this GCC Sub-Clause 25.3 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 25.3.

25.4 In this GCC Clause 25, the expression "Facilities executed" shall include all work executed, Installation Services provided, and all Plant 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.

25.4 In this GCC Clause 25, in calculating any monies due from the Owner to the Contractor, account shall be taken of any sum previously paid by the Owner to the Contractor under the Contract, including any advance payment.

26. Members of the Employer/ Owner not individually Liable

26.1 No Director, or official or employee of the Employer/ Owner shall in any way be personally bound or liable for the acts or obligations under the Contract or answerable for any default or omission in the observance or performance of any of the acts, matters or things which are herein contained.

27. Employer/Owner not bound by Personal Representations

27.1 The Contractor shall not be entitled to any increase on the price or any other right or claim whatsoever by reason of any representation, explanation statement or alleged representation, promise or guarantees given or alleged to have been given to him by any person.

28. Contractor's office at Site & Vehicle requirement for Mobility at site

28.1 The Contractor shall provide and maintain an office at the site for the accommodation of his agent and staff (With meeting room) and such office shall be open at all reasonable hours to receive instructions, notice or other communications. The contractor shall make provisions and arrangements at site locations for temporary office (Portacabin) including all basic amenities having electricity, furniture, Air Conditioning, Sanitation, toilet facilities, etc. at his own cost on behalf &

purpose of the Employer and his staff and shall get the clearance of local authorities for setting up/construction of such facilities. Bidders are required to consider all such temporary office construction cost into his account, while bidding. These facilities shall be provided till the final handing over of the project to the Owner. The contractor shall ensure that the area is kept clean and sanitary conditions are maintained as laid down by the local authorities controlling the area.

Further contractor shall also provide & ensure availability of required Vehicle (Preferably SUV Segment Vehicles requiring Off Roding) with driver and fuel/Maintenance/Consumables etc for the purpose of Mobility in and around the site for official purposes for the Employer & its staff. The vehicle mas mentioned is to be provided during project construction and O&M period and inspection by SECI as per requirement, failing which SECI shall have full right for alternate arrangement at the risk & cost of the contractor

29. Contractor's Subordinate Staff and their Conduct

- 29.1 The Contractor, on or after award of the Work shall name and depute a qualified Engineer having sufficient experience in carrying out work of similar nature, to whom the equipment, materials, if any, shall be issued and instructions for works given. The Contractor shall also provide sufficient and qualified staff to superintend the execution of the Work, competent sub-agents, foremen and leading hands including those specially qualified by previous experience to supervise the types of works contained in the Contract in such manner as will ensure work of the best quality, expeditious working. Whenever in the opinion of the Engineer-in-Charge/Project Manager additional properly qualified supervisory staff is considered necessary, they shall be employed by the Contractor without additional charge on accounts thereof. The Contractor shall ensure that Sub-Contractors, if any, shall provide competent and efficient supervision, over the work entrusted to them.
- 29.2 If and whenever any of the Contractor's or Sub-Contractor's agents, sub-agents, assistants, foremen, or other employees be guilty of any misconduct or be incompetent or insufficiently qualified or negligent in the performance of their duties, it is undesirable for administrative or any other reason for such person or persons to be employed in the works, the Contractor, shall at once remove such person or persons from employment thereon. Any person or persons so removed from the works shall not again be employed in connection with the Works. Any person so removed from the Work shall be immediately replaced at the expense of the Contractor by a qualified and competent substitute. Should the Contractor be requested to repatriate any person removed from the works he shall do so and shall bear all costs in connection herewith.
- 29.3 The Contractor shall be responsible for the proper behavior of all the staff, foremen, workmen, and others, and shall exercise a proper degree of control over them and in particular and without prejudice to the said generality, the Contractor shall be bound to prohibit and prevent any employees from trespassing or acting in any way detrimental or prejudicial to the interest of the community or of the properties or occupiers of land and properties in the neighborhood and in the event of such employee so trespassing, the Contractor shall be responsible therefore and relieve the Owner of all consequent claims or actions for damages or injury or any other grounds whatsoever. The Contractor shall be liable for any liability to Owner on account of deployment of Contractor's staff etc. or incidental or arising out of the execution of Contract. The Contractor shall be liable for all acts or omissions on the part of his staff, Foremen and Workmen and others in his employment, including misfeasance or negligence of whatever kind in the course of their work or during their employment, which are connected directly or indirectly with the Contract.
- 29.4 If and when required by the Owner and Contractor's personnel entering upon the Owner's premises shall be properly identified by badges or gate passes which must be worn at all times on Owner's premises. Contractor may be required to obtain daily entry passes for his Staff/ Employees to work within operating areas. These being safety requirements, no relaxations on this account shall be given to Contractor.

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29.5 Contractor shall at all times provide Employer/ SECI access to site and office during construction/ O&M periods and also provide them with any data/ information sought for.

30. Sub-letting of Works

30.1 Sub-contracting other than for labour contract/engagement of labour, shall be permitted with the information to the Employer. However, sub-contracting for 100% of the contract on back to back basis shall not be permitted. Any part of the Contract nor any share or interest therein shall in any manner or degree be transferred, assigned or sublet by the Contractor directly or indirectly to any person, firm or corporation whatsoever without the consent in writing, of the Employer except as provided for in the succeeding Clause.

i) Sub-Contracts for Temporary Works etc.

The Employer may give written consent to Sub-Contract for the execution of any part of the Work at the site, being entered in to by Contractor provided each individual Sub-contract is informed to the Engineer-in-Charge/Project Manager.

ii) List of Sub-Contractors to be supplied

The Contractor shall furnish to the Engineer-in-Charge/Project Manager list of all Sub-Contractors or other persons or firms engaged by the Contractor and working at the Site during the previous month with particulars of the general nature of the Subcontract or works done by them.

iii) Contractor's Liability not Limited by Sub-Contractors

Notwithstanding any sub-letting with such approval as aforesaid and notwithstanding that the Engineer-in-Charge/Project Manager shall have received copies of any Subcontracts, the Contractor shall be and shall remain solely responsible for the quality, proper and expeditious execution of the Contract in all respects as if such sub-letting or Subcontracting had not taken place, and as if such work had been done directly by the Contractor. The Contractor shall bear all responsibility for any act or omission on the part of sub-Contractors in regard to work to be performed under the Contract.

iv) No Remedy for Action Taken under this Clause

No action taken by the Owner under the clause shall relieve the Contractor of any of his liabilities under the Contract or give rise to any right or compensation, extension of time or otherwise failing which the Owner shall have the right to remove such Sub-Contractor(s) from the site.

vi) Termination/ Cancellation of Contract

Owner is nowhere liable for the communication, acts and deeds and performance of the sub-Contractor as engaged by the principal Contractor. Principal Contractor solely is responsible and liable for the entire execution of project and performance of contract.

Subject to poor performance and prolonged delay of the project on account of inefficient sub-letting of the project work, Owner may take a final decision to terminate the contract of the principal Contractor which will be binding and non-revertible and henceforth no plea in this regard shall be entertained.

vii) 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 Sub-Contractors 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 Owner. Nothing contained in the Contract or in any subcontract awarded by the Contractor shall be construed to

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create any contractual relationship between any such employees, representatives or Sub-Contractors and the Owner.

viii) Under no circumstances the sub-Contractor shall claim or shall put any binding to the Owner and at all times the sub-Contractor must be managed by the Contractor. The Owner shall not be responsible for any claims at any time by the Contractor in relation to the sub-Contractor.

ix) 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.

x) 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.

xi) The Contractor shall be solely responsible for ensuring that his sub-Contractors fulfil and comply with the statutory requirements of Labour and other Laws.

31. Power of Entry

31.1 If the Contractor shall not commence the Work in the manner previously described in the Contract documents or if he shall at any time in the opinion of the Engineer-in-Charge/Project Manager:

- i) fail to carry out the Work in conformity with the Contract documents, or
- ii) fail to carry out the Work in accordance with the Time Schedule, or
- iii) substantially suspend the Work for a period of minimum 14 (Fourteen) days without authority from the Engineer-in-Charge/Project Manager, or
- iv) fail to supply sufficient or suitable construction plant, temporary works, labour, materials or things, or
- v) Commit, suffer, or permit any other breach of any of the provisions of the Contract on his part to be performed or observed or persist in any of the above-mentioned breaches of the Contract for 14 (Fourteen) days, after notice in writing shall have been given to the Contractor by the Engineer-in-Charge/Project Manager requiring such breach to be remedied, or
- vi) if the Contractor abandon the Work, or
- vii) If the Contractor during the continuance of the Contract shall become bankrupt, make any arrangement or composition with his creditors or go into liquidation whether compulsory or voluntary not being merely a voluntary liquidation for the purpose of amalgamation or reconstruction

then in any such case, the Owner shall have the power to enter upon site and take possession thereof and of the materials, temporary Work, construction plant, and stock thereon, and to revoke the Contractor's license to use the same, and to complete the Work by his agents, other Contractors or workmen or to sublet the same upon any terms and to such other person, firm or corporation as the Owner in his absolute discretion may think proper to employ and for the purpose aforesaid to use or authorize the use of any materials, temporary work, Construction Plant, and stock as aforesaid, without making payment or allowance to the Contractor for the said materials other than such as may be certified in writing by the Engineer-in-Charge/Project Manager to be reasonable, and without making any payment or allowance to the Contractor for the use of the temporary said works, construction plant and stock or being liable for any loss or damage thereto, and if the Owner shall by reason of his taking possession of the Work or of the Work being completed by other Contractor (due account being taken of any such extra work or works which may or be omitted) then the amount of such excess shall be deducted from any money which may be due for work done by the Contractor under the Contract and not paid for.

Any deficiency shall forthwith be made good and paid to the Owner by the Contractor and the Owner shall have power to sell in such manner and for such price as he may think fit all or any of the

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construction plant, materials etc. constructed by or belonging to Contractor and to recoup and retain the said deficiency or any part thereof out of proceeds of the sale.

32. Contractor's responsibility

32.1 Contractor's responsibility

- 32.1.1 The Contractor shall grade/level the land identified for development of the mentioned Solar power Plant along with the design, procure, manufacture (including associated purchases and/or subcontracting), install, commission and complete the Facilities, carry out the Guarantee tests with due care and diligence in accordance with the Contract along with interconnecting transmission system including Right of Way for Transmission Line and the comprehensive O&M of the complete facilities for the period as defined under the tender document . It is Contractor's responsibility to coordinate with state/central agencies in order to get any permission whatsoever, required for successful development & operation of Plant till its desired life.
- 32.1.2 The Contractor shall acquire, on behalf of Owner, in the Owner's name, all permits, approvals and/or licenses from all local, state or national government authorities or public service undertakings in the Country/State where the Site is located that are necessary for the setting up of the Plant & operation of Plant till its desired life as mentioned under the Contract, including, but not limited to, entry permits for all imported Owner's/Employer's Equipment (if any). In this regard, any document required from Owner/ Employer shall be intimated at least 10 days prior to submission. Contractor has to ensure safe keeping of the documents and diligent use. It is the responsibility of the Contractor to safe keep and return all the original approvals, permits, licenses, certificates and other relevant document generated as a result of the setting up of project and comprehensive O&M process to the Owner.
- 32.1.3 In the matter of connectivity of Plant to DISCOM's substation, the Owner will take the necessary connectivity permission, however, all the other permissions and clearances as deemed required by the State Agency/DISCOM for Bay allocation, technical/regulatory compliance for interconnection, ROW etc are to be taken by the Contractor. Statutory fees pertaining to such shall be reimbursed by the Owner on production of the documentary evidence/Demand note over and above the contract value. Further, Contractor shall also facilitate Owner in getting the required permissions/agreements as required for the energy accounting by State agencies/DISCOM.
- 32.1.4 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, but not limited to, the right of way for the access to site and for erection of transmission lines as applicable, visas for the Contractor's and Sub-Contractor'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 Owner and that are necessary for the Performance of the Contract.
- 32.1.5 Contractor shall also seek for any exemption applicable for the project as per the orders released from GOI time to time in appropriate Formats including all the required attachments. In this regard, Contractor shall be responsible to take all necessary certificates as a proof of exemptions on behalf of Owner. However, all the documents required from Owner, as needed for the process, will be provided by Owner. The demand of such documents shall be made to the Owner in at least 10 days advance.
- 32.1.6 The Contractor shall comply with all laws in force at the place, where the Facilities are installed and where the Installation Services are carried out. The laws will include all national, provincial, municipal labour or other laws that affect the Performance of the Contract and binding upon the Contractor. The Contractor shall indemnify and hold harmless the Employer/Owner 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.

32.1.7 Any plant, material, spares & spares inventory and services that will be incorporated in or be required for the facilities.

32.1.8 Unless otherwise specified in the Contract or agreed upon by the Owner and the Contractor, the Contractor shall provide/ deploy sufficient, properly qualified operating and maintenance personnel; shall supply and make available all raw materials, spares, tools and tackles and other materials and facilities; and shall perform all work and services of whatsoever nature, to properly carry out Pre-commissioning, Commissioning and Guarantee Tests, all in accordance with the provisions of "Scope of Works and Supply by the Owner/Employer" to the Contract Agreement at or before the time specified in the program furnished by the Contractor and in the manner thereupon specified or as otherwise agreed upon by the Owner/ Employer and the Contractor.

33. Other Agencies at Site

33.1 The Contractor shall have to execute the Work in such place and conditions where other agencies may also be engaged for other works such as site grading, filling, and levelling, electrical and mechanical engineering works, etc. No claim shall be entertained due to Work being executed in the above circumstances. The Contractor shall allow such agencies to use the facilities like roads, etc constructed by the Contractor in order that they are able to carry out their respective scope of works unhindered

34. Notice

34.1 To the Contractor

Any notice hereunder may be served on the Contractor or his duly authorized representative at the job site or may be served.

Any communication sent shall be confirmed within two (2) days after receipt. Any communication sent by facsimile or e-mail shall be deemed to have been delivered on date of its dispatch and personal delivery deemed to have been delivered on date of delivery. Either party may change its postal, facsimile or e-mail address or addresses for receipt of such notices by ten (10) days' notice to the other party in writing.

34.2 To the Employer/Owner

Any notice to be given to the Employer/Owner under the terms of the Contractor shall be served by sending the same by mail to or delivering the same at the offices of Employer/ Owner at the mentioned address in the Tender document.

35. Right of Various Interests

35.1 i) The Owner reserves the right to distribute the work between more than one agency(ies). The Contractor shall cooperate and afford other agency(ies) reasonable opportunity for access to the Work for the carriage and storage of materials and execution of their works.

ii) Wherever the work being done by any department of the Employer/ Owner or by other agency(ies) employed by the Employer/ Owner is contingent upon Work covered by this Contract, the respective rights of the various interests involved shall be determined jointly to secure the completion of the various portions of the work in general harmony.

36. Patents and Royalties

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- 36.1 The copyright in all drawings, documents and other materials containing data and information furnished to the Owner/ Employer by the Contractor herein shall remain vested in the Contractor or, if they are furnished to the Owner/ 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 Owner/ Employer shall however be free to reproduce all drawings, documents, specification and other material furnished to the Owner/ Employer for the purpose of the contract including, if required, for operation and maintenance of the facilities.

The Contractor shall indemnify the Owner/ Employer against third party claims of infringement of patent, trademark or industrial design rights arising from use of goods or any part thereof in India.

The Contractor, if licensed under any patent covering equipment, machinery, materials or compositions of matter to be used or supplied or methods and process to be practiced or employed in the performance of this Contract, agrees to pay all royalties and license fees which may be due with respect thereto. If any equipment, machinery, materials, composition of matters, be used or supplied or methods and processes to be practiced or employed in the performance of this Contract, is covered by a patent under which the Contractor is not licensed then the Contractor before supplying or using the equipment, machinery materials, composition method or processes shall obtain such licenses and pay such royalties and license fees as may be necessary for performance of this Contract. In the event the Contractor fails to pay any such royalty or obtain any such license, any suit for infringement of such patents which is brought against the Contractor or the Employer/ Owner as a result such failure will be defended by the Contractor at his own expense and the Contractor will pay any damages and costs awarded in such suit. The Contractor shall promptly notify the Employer/ Owner if the Contractor has acquired the knowledge of any plant under which a suit for infringement could be reasonably brought because of the use by the Owner of any equipment, machinery, materials, process, methods to be supplied hereunder. The Contractor agrees to and does hereby grant to Employer/ Owner, together with the right to extend the same to any of the subsidiaries of the Employer/ Owner as irrevocable, royalty free license to use in any country, any invention made by the Contractor or his employee in or as result of the performance of the Work under the Contract.

- 36.2 All charges on account of royalty, toilage, rent or any other levy on materials obtained for the work or temporary work or part thereof (excluding materials provided by the Employer/ Owner, if any) shall be borne by the Contractor.
- 36.3 The Contractor shall not sell or otherwise dispose of or remove except for the purpose of this Contract, the sand, stone, clay, ballast, earth, rock or other substances, or materials obtained from any excavation made for the purpose of the Work or any building or produce upon the site at the time of delivery of the possession thereof, but all such substances, materials, buildings and produce shall be the property of the Owner provided that the Contractor use the same for the purpose of the work.
- 36.4 The copyright in all drawings, documents and other materials containing data and information furnished to the Employer/Owner by the Contractor herein shall remain vested in the Contractor or, if they are furnished to the Employer/Owner 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/Owner shall however be free to reproduce all drawings, documents, specification and other material furnished to the Employer/Owner for the purpose of the contract including, if required, for operation and maintenance of the facilities.
- 36.5 The Employer/Owner and the Contractor shall keep confidential and shall not, without the written consent of the other party hereto, divulge to any third party any documents, data or other information furnished directly or indirectly by the other party hereto in connection with the Contract, whether such information has been furnished prior to, during or following termination of the Contract. Notwithstanding the above, the Contractor may furnish to its Sub-Contractor(s) such documents, data and other information it receives from the Employer/Owner to the extent required for the Sub-

Contractor(s) to perform its work under the Contract, in which event the Contractor shall obtain from such Sub-Contractor(s) an undertaking of confidentiality similar to that imposed on the Contractor under this clause.

36.6 The Employer/Owner 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/Owner 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.

- The obligation of a party under GCC Sub-Clauses 36.5 and 36.6 above, however, shall not apply to that information which
- Now or hereafter becomes available in the public domain through no fault of that party
- 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.
- Otherwise lawfully becomes available to that party from a third party that has no obligation of confidentiality.
- The above provisions of this Clause 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.
- The provisions of this clause shall survive termination, for whatever reason, of the Contract.

37. Liens

37.1 If, at any time there should be evidence or any lien or claim for which the Owner might have become liable and which is chargeable to the Contractor, the Owner shall have the right to retain out of any payment then due or thereafter to become due an amount sufficient to completely indemnify the Owner against such lien or claim and if such lien or claim be valid, the Owner may pay and discharge the same and deduct the amount so paid from any money which may be or may become due and payable to the Contractor. If any lien or claim remain unsettled after all payments are made, the Contractor shall refund or pay to the Owner all money that the latter may be compelled to pay in discharging such lien or claim including all costs and reasonable expenses. Owner reserves the right to do the same.

37.2 The Owner shall have lien on all materials, equipment including those brought by the Contractor for the purpose of erection, testing and commissioning of the Work.

37.3 The final payment shall not become due until the Contractor delivers the complete release or waiver of all liens arising or which may arise out of his agreement or receipt in full or certification by the Contractor that all invoices for labour, materials, services have been paid in lien thereof and if required in any case an affidavit that so far as the Contractor has knowledge or information the releases and receipts include all the labour and material for which a lien could be filled.

37.4 Contractor will indemnify and hold the Employer/ Owner harmless, for a period of 02 (Two) years after the issue of Final Acceptance from all liens and other encumbrances against the Employer/ Owner on account of debts or claims alleged to be due from the Contractor or his Sub-Contractor to any person including Sub-Contractor and on behalf of Employer/ Owner will defend at his own expense, any claim or litigation brought against the Employer/ Owner or the Contractor in connection therewith. Contractor shall defend or contest at his own expense any fresh claim or litigation by any person including his Sub-Contractor, till its satisfactory settlement even after the expiry of 02 (Two) years from the date of issue of Final Acceptance.

38. Delays by Employer/ Owner or his Authorized representatives

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38.1 In case the Contractor's performance is delayed due to any act or omission on the part of the Employer/ Owner or his authorized representatives, then the Contractor may be given due extension of time for the completion of the Work after proper due diligence by Employer/ Owner, to the extent such omission on the part of the Employer/ Owner has caused delay in the Contractor's performance of his Work.

38.2 No adjustment in Contract Price shall be allowed for reasons of such delays and extensions granted except as provided in Tender Document, where the Employer/ Owner reserves the right to seek indulgence of Contractor to maintain the agreed Time Schedule of Completion. In such an event the Contractor shall be obliged for working by Contractor's personnel for additional time beyond stipulated working hours as also Sundays and Holidays and achieve the completion date/interim targets.

39. Payment if the Contract is terminated

39.1 If the Contract shall be terminated as per the provisions of the Tender/ Contract, the Contractor shall be paid by the Owner in so far as such amounts or items shall not have already been covered by payments of amounts made to the Contractor for the Work executed prior to the date of termination at the cost provided for in the Contract and in addition to the following:

- a) The amount payable in respect of any preliminary items, so far as the Work or service comprised therein has been carried out or performed and an appropriate portion as certified by Engineer-in-Charge of any such items or service comprised in which has been partially carried out or performed.
- b) Any other expenses which the Contractor has expended for performing the Work under the Contract subject to being duly recommended by Engineer-in-Charge/Project Manager and approved by Employer/ Owner for payment, based on documentary evidence of his having incurred such expenses.

39.2 The Contractor will be further required to transfer the title, Guarantee/Warranty of the Material/Products/Spares of the works & Projects including but not limited to PV Modules, Power Conditioning Units (PCU)/ Inverters, Transformers, Batteries (If applicable) etc and provide the following in the manner and as directed by the Employer/ Owner.

- a) Any and all completed works.
- b) Such partially completed Work including drawings, information and Contract rights as the Contractor has specially performed, produced or acquired for the performance of the Contractor.

40. No Waiver of Rights

40.1 Neither the inspection by the Employer/ Owner or any of their officials, Employees or representatives nor any order by the Employer/ Owner for payment of money or any payment for or acceptance of the whole or any part of the Work by the Employer/ Owner nor any extension of time, nor any possession taken by Owner shall operate as a waiver of any provision of the Contract, or of any power herein reserved to the Employer/ Owner, or any right to damages herein provided, nor shall any waiver of any breach in the Contract be held to be a waiver of any other subsequent breach.

41. Certificate not to Affect Right of Employer and Liability of Contractor

41.1 No interim payment certificate(s) issued by the Employer/ Owner, nor any sum paid on account by the Employer/ Owner, nor any extension of time for execution of the work granted by Employer/ Owner shall affect or prejudice the rights of the Employer/ Owner against the Contractor or relieve the Contractor of his obligations for the due performance of the Contract, or be interpreted as approval of the Work done or of the equipment supplied and no certificate shall create liability for the Employer/ Owner to pay for alterations, amendments, variations or additional works not ordered, in writing, by Employer/ Owner or discharge the liability of the Contractor for the payment of

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damages whether due, ascertained, or certified or not or any sum against the payment of which he is bound to indemnify the Employer/ Owner.

42. Language and Measures

42.1 All documents pertaining to the Contract including Specifications, Schedules, Notices, Correspondence, Operating and Maintenance Instructions, Drawings or any other writing shall be written in English language only. The SI System of measurement shall be used in the Contract unless otherwise specified. Any literature/standard required for the execution of the project work will be provided by the Contractor in the English language only.

43. Guarantee Tests & Operational Acceptance and Transfer of Title

43.1 Functional Guarantees

43.1.1 The Contractor guarantees that during the Guarantee Test, the Facilities and all parts thereof shall attain the Functional Guarantees specified under Technical Specifications, subject to and upon the conditions therein specified. Respective compensation in case of the Non-achievement of the same is mentioned in the SCC of the tender document.

43.1.2 If, for reasons attributable to the Contractor, the guaranteed level of the Functional Guarantees specified under Technical Specifications are not met either in whole or in part, the Contractor shall, within a mutually agreed time, at its cost and expense make such changes, modifications and/ or additions to the Plant or any part thereof as may be necessary to meet such Guarantees. The Contractor shall notify the Employer/Owner upon completion of the necessary changes, modifications and/or additions, and shall seek the Employer's/Owner's consent to repeat the Guarantee Test. If the level of the specified Functional Guarantee parameters, as demonstrated even during repeat of the Guarantee Test(s), are outside the acceptable shortfall limit, the Employer//Owner may at its option, either

- Reject the Equipment and advise immediate replacement to suit the provisions of Technical Specification without any additional cost or;
- Reject the Equipment and recover the payments already made, or;
- Terminate the Contract and recover the payments already made, or;
- Accept the equipment after levy of liquidated damages in accordance with the provisions specified.

43.2 Plant Performance Guarantee Test

The Plant Performance Guarantee (as mentioned in TS) Test shall be conducted by the Contractor after Commissioning of the Facilities to ascertain whether the Facilities or the relevant part(s) can attain the Functional Guarantees specified in the Contract Documents. The Contractor's and Project Manager's advisory personnel shall attend the Guarantee Test. The detailed procedure for Performance Guarantee Test shall be carried out as per procedure laid down in Technical Specifications.

43.3 Operational Acceptance

43.3.1 Operational Acceptance shall occur in respect of the Facilities when:

- a) The Plant Performance Guarantee in accordance with the procedure specified in "Technical Specifications" has been successfully completed and the Functional Guarantees are met.
- b) Completion of the Facilities have been achieved as per Technical Specifications

43.3.2 The milestone payment linked with successful Operation acceptance shall be released subjected to following:

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- a) All "As- Built" Drawings and documents are submitted.
- b) Detailed Engineering Document with detailed specification, schematic drawing, circuit drawing, cable routing plans and test results, manuals for all deliverable items, Operation, Maintenance & Safety Instruction Manual and other information about the project are submitted
- c) Bill of material of the installed Facility is submitted.
- d) Inventory of recommended and mandatory spares including special tools and tackles at project Site are provided
- e) All the required approvals and NOC's as required, are submitted
- f) List of deviation from the approved drawings with reason for deviation is submitted
- g) List of punch points, duly signed, is provided.
- h) Settlement of liquidity damages against delay and performance (Liquidity Damages)
- i) Certificates of final levels as set out for various works
- j) Certificates of tests performed for various Works.
- k) Material appropriation, Statement for the materials issued by the Owner, if applicable for the Work and list of surplus materials returned to the Owner's store duly supported by necessary documents.
- l) Warranty certificates for each equipment are handed over to Owner' and 'Statutory approvals/ permits/ NOC are handed over to Owner'
- m) Supply of all mandatory and recommend spares

43.3.3 At any time after the events set out in GCC Sub- Clause 43.3.1 have occurred, the Contractor may give a notice to the Project Manager/EIC requesting the issue of an Operational Acceptance Certificate in the 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.

43.3.4 The Owner shall, after consultation with the Project Manager/EIC, and within thirty (30) days after receipt of the Contractor's notice, issue an Operational Acceptance.

43.3.5 If within thirty (30) days after receipt of the Contractor's notice, the Project Manager fails to issue the Operational Acceptance or fails to inform the Contractor in writing of the justifiable reasons why the Owner has not issued the Operational Acceptance, the Facilities shall be deemed to have been accepted as at the date of the Contractor's said notice.

43.3.6 The start date of the Comprehensive Operation and Maintenance shall be reckoned from the date mentioned in the Operational Acceptance Certificate.

43.4 Final Acceptance

43.4.1 Final Acceptance shall occur in respect of the Facilities when:

- a) The plant has achieved the Operational acceptance; and
- b) Handing over – Taking over of Plant should have been completed; and
- c) Successful demonstration of the performance guarantees
- d) Contractor has provided the list of recommended spares with detailed specification, source and price for further procurement; and
- e) The Contractor has paid the liquidated damages, if any, as specified in SCC thereto;
- f) Account reconciliation and NCR/ Punch list closure.

43.4.2 At any time after the events set out in GCC Sub – Clause 43.4.1 have occurred, the Contractor may give a notice to the Project Manager/EIC requesting the issue of Final Acceptance in the 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.

43.4.3 The Employer shall, after consultation with the Project Manager/EIC, and within thirty (30) days after receipt of the Contractor's notice, issue Final Acceptance.

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43.4.4 If within thirty (30) days after receipt of the Contractor's notice, the Owner fails to issue the Final Acceptance or fails to inform the Contractor in writing of the justifiable reasons why the Owner has not issued the Final Acceptance, the Facilities shall be deemed to have been accepted as at the date of the Contractor's said notice.

43.4.5 The O&M contract period may further be extended for a period as per mutually agreed terms and conditions.

43.4.6 In case the Owner wishes to extend the O&M period beyond the agreed period under this contract, he shall intimate Contractor at least 6 months prior to the completion period. The Contractor may accept the offer as per the terms and conditions to be mutually agreed with the Owner.

44. Release of Confidential Information

44.1 The Contractor shall not communicate or use in advertising, publicity, sales releases or in any other medium, photographs, or other reproduction of the Work under this Contract or description of the site dimensions, quantity, quality or other information, concerning the Work unless prior written permission has been obtained from the Employer/ Owner.

44.2 The Owner/ 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 Sub Contractor(s) such documents, data and other information it receives from the Employer/Owner to the extent required for the Sub Contractor(s) to perform its work under the Contract, in which event the Contractor shall obtain from such Sub Contractor(s) an undertaking of confidentiality similar to that imposed on the Contractor.

44.3 The Owner/ 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 Owner/ 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.

44.4 The obligation of a party above, however, shall not apply to that information which

- Now or hereafter enters the public domain through no fault of that party
- 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.
- Otherwise lawfully becomes available to that party from a third party that has no obligation of confidentiality.

44.5 The above provisions of this GCC 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.

44.6 The provisions of this GCC Clause 44 shall survive termination, for whatever reason, of the Contract.

45. Operation & Maintenance

45.1 The Operation and Maintenance shall be comprehensive. The maintenance service provided shall ensure project functioning of the Solar PV system as a whole and Power Evacuation System to the extent covered in the Contract. All preventive / routine maintenance and breakdown / corrective maintenance required for ensuring maximum uptime shall have to be provided. Accordingly, the Comprehensive Operation & Maintenance shall have two distinct components as described below:

45.2 Preventive / Routine Maintenance:

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This shall be done by the Contractor regularly and shall include activities such as cleaning and checking the health of the Solar PV system, cleaning of module surface, tightening of all electrical connections, and any other activity including the associated civil works, as mentioned in TS, wear and tear that may be required for proper functioning of the Solar PV system as a whole. Necessary maintenance activities, Preventive and Routine for Transformers and associated switch gears and transmission line also shall be included.

45.3 Breakdown / Corrective maintenance:

Whenever a fault occurs, the Contractor has to attend to rectify the fault & the fault must be rectified within the 72 hours from the time of occurrence of fault. The Contractor must maintain all the records pertaining to all such faults and necessary measures taken.

The date of Comprehensive Operation & Maintenance Contract period shall begin from the date of Operational acceptance. However, operation of the Power Plant means operation of system as per TS and workmanship in order to keep the project trouble free covering the O&M period. The Contractor must demonstrate the committed CUF at the end of every year in accordance with commitment made in line with the Performance guarantees.

45.4 Serviceability Level Agreement (SLA)

45.4.1 Contractor shall make efforts to maintain 100 % serviceability of complete Plant including all other associated infrastructure developed by the Contractor during execution of project as its scope of work & the respective report of the same shall be submitted to the Owner.

45.4.2 Contractor shall maintain a Complaint log book, which shall include the timing of logging of complaint including unique Complaint number, time of closure of complaint & it's Root Cause Analysis.

45.4.3 Contractor will be responsible for maintaining the Insurance Policy for the complete Plant and Facilities during the O&M period also. He shall maintain seamless insurance cover during Construction and O&M phases. Copy of policies shall be given to the Owner.

45.4.4 Such rectification work carried out by Owner doesn't exempts/relieves Contractor from its responsibility towards subsequent operation, maintenance, repair & replacement of such component/ infrastructure of the Plant or meeting the performance parameters of the Plant.

45.4.5 O&M Routine & Manpower: Contractor shall provide Preventive / Routine Maintenance schedule based on Original Equipment manufacturer and good engineering practices. The team deployed for the O&M must have the sufficient experience of executing the similar tasks.

However, Contractor shall engage additional manpower as and when need arise.

45.5 Bidder is requested to provide the list of all the spares required to maintain the facility for O&M period. Contractor agrees to supply such spare parts, as recommended or otherwise required for the effective and hassle-free operation and maintenance of the Facilities. However, the Contractor, with its previous experience, is to provide a list of spares including specifications, supplier details and indicative price, as recommended by him and OEM. The Contractor shall keep and maintain the inventory of such spares for the hassle-free operation during the complete O&M period without additional cost to Owner. Also, at the end of penultimate year of the O&M contract, Contractor shall supply a list of all recommended spares as per the operational requirement of the plant and with reference to the mean time between failures (MTBF), along with detailed specifications, supplier details and tentative cost for future purchase. The price of such spare parts shall include the breakup of taxes and duties as applicable towards purchase and supply of spare parts. Owner, at its discretion, will purchase the spare as required for future operation. However, the Contractor shall replenish the mandatory spares at his cost prior to the completion of the O&M period.

46. Completion of Contract

- 46.1 Unless otherwise terminated under the provisions of any other relevant clause, this Contract shall be deemed to have been completed at the expiration of the Period of Liability/ Validity of the Contract as provided under Section - V, Special Conditions of Contract (SCC).

47. Pre - Commissioning & Commissioning

- 47.1 As soon as installation of the Facilities has, in the opinion of the Contractor, been completed as specified in the Technical Specifications, excluding items not materially affecting the operation or safety of the Facilities, the Contractor shall so notify the Project Manager/ EIC in writing to witness the pre- commissioning of the facility.
- 47.2 If the Project Manager/EIC is satisfied that the Facilities have reached Completion, the Project Manager/EIC shall, within seven (7) days after receipt of the Contractor's notice, arrange to witness the pre – commissioning of the Facilities.
- 47.3 If the Project Manager/EIC 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 47.1.
- 47.4 If the Project Manager/EIC is still 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 repeat notice, and the above procedure shall be repeated.
- 47.5 As soon as all works in respect of Pre-commissioning are completed and, in the opinion of the Contractor, the Facilities are ready for Commissioning, the Contractor shall so notify the Project Manager in writing. The Contractor shall commence Commissioning of the facilities as per the GCC Sub – Clause 47.6.
- 47.6 Commissioning of the Facilities shall be completed by the Contractor as per procedures detailed in the Technical Specifications and in the presence of the Project Manager/ EIC and Owner.
- 47.7 If the Project Manager/EIC 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 47.1 or within seven (7) days after receipt of the Contractor's repeated notice under GCC Sub-Clause 47.3, then the Facilities shall be deemed to have taken up the date of the Contractor's notice or repeated notice, accepted for commissioning, as the case may be.
- 47.8 As soon as possible after Commissioning, 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 monies owing to the Contractor.
- 47.9 As soon as possible after Commissioning, the Contractor shall make the facility ready for the performance test (PR test) and inform the Project Manager/EIC at least 7 (seven) days prior to the start of the performance test as per the procedure mentioned in the Technical Specifications.
- 47.10 Upon successful Operational Acceptance of the Facilities as per GCC sub clause 43.3, the Contractor shall be responsible for the care and custody of the Facilities, together with the risk of loss or damage thereto, and shall thereafter take over the Facilities or the relevant part thereof for the agreed duration of comprehensive operation and maintenance as stipulated and mutually agreed terms and conditions.

[E] PERFORMANCE OF WORK

48. Execution of Work

- 48.1 All the Works shall be executed in strict conformity with the provisions of the Contract Documents and with such explanatory detailed drawings, specification and instructions as may be furnished from time to time by the Contractor whether mentioned in the Contract or not. The Contractor shall be responsible for ensuring that works throughout are executed in the most substantial, proper and workmanlike manner with the quality of material and workmanship in strict accordance with the Specifications. The Contractor shall provide all necessary materials, equipment, labour etc. for execution and maintenance of Work till completion unless otherwise mentioned in the Contract.
- 48.2 All materials shall be brand new & of the best quality and workmanship capable of satisfactory operation under the operating and climatic conditions as has been specified. Unless otherwise specified, they shall conform in all respect to the latest edition of the relevant IS codes specification wherever Indian specifications apply or IEC codes or equivalent internationally accepted standard.
- 48.3 The Contractor shall supply & deliver all equipment and materials for installation at site. The Contractor shall arrange for transportation, loading & unloading, local sifting, EAR insurance and safe storage of materials at project site at his own cost & risk.
- 48.4 If the Contractor offers equipment manufactured in accordance with other international well recognized standards (mentioned above), he shall, in that case, supply a copy in English of the Standard Specification adopted and shall clearly mention in what respect such standard specification differs from Indian Standard Specifications. The Plant, equipment, and materials offered by the Contractor should comply with one consistent set of Standards only to make the system compatible and work in harmony as far as possible, except if mentioned otherwise.

49. Void

50. Work in Monsoon and Dewatering

- 50.1 Unless otherwise specified elsewhere in the tender, the execution of the Work may entail working in the monsoon also. The Contractor must maintain a minimum labour force as may be required for the job and plan and execute the construction and erection according to the prescribed schedule. No extra rate will be considered for such work in monsoon.
- 50.2 During monsoon and other period, it shall be the responsibility of the Contractor to keep the construction work site free from water logging at his own cost.

51. Change in Laws and Regulations

- 51.1 If, after the date seven (7) days prior to the date of Bid submission, in the country where the Site is located, any law, regulation, ordinance, order or by-law having the force of law is enacted, promulgated, abrogated or changed (which shall be deemed to include any change in interpretation or application by the competent authorities) that subsequently affects the costs and expenses of the Contractor and/or the Time for Completion, the Contract Price shall be correspondingly increased or decreased, and/or the Time for Completion shall be reasonably adjusted to the extent that the Contractor has thereby been affected in the Performance of any of its obligations under the Contract. Contractor shall promptly and within 15 days of such enactment coming into force, forward relevant supporting documents to Owner

However, these adjustments would be restricted to direct transactions between the Employer and Contractor and Bought out items (dispatched directly from sub vendor's works to Site). These adjustments shall not be applicable on procurement of raw materials, intermediary components and intermediary services etc. by the Contractor.

Notwithstanding the foregoing, such additional or reduced costs shall not be separately paid or credited if the same has already been accounted for in the price adjustment provisions where applicable.

The term Change in Law shall refer to the occurrence of any of the following events pertaining to this project only after the last date of the bid submission, including (i) the enactment of any new law; or (ii) an amendment, modification or repeal of an existing law; or (iii) any change in the rates of any Taxes including any duties and cess or introduction of any new tax made applicable for setting up the project.

However, Change in Law shall not include (i) any change in taxes on corporate income or (ii) any change in any withholding tax on income or dividends distributed to the shareholders of the Contractor, or (iii) any change on account of regulatory measures by the Appropriate Commission.

52. General Conditions for Construction and Erection Work

- 52.1 Overtime work is permitted in cases of need and the Owner will not compensate the same. Shift working at 2 or 3 shifts per day may become necessary and the Contractor should take this aspect into consideration for formulating his rates. No extra claims will be entertained by the Owner on this account.
- 52.2 The Contractor must arrange for the placement of workers in such a way that the delayed completion of the Work or any part thereof for any reason whatsoever will not affect their proper employment. The Owner will not entertain any claim for idle time payment whatsoever.
- 52.3 The Contractor shall submit to the Owner/ Employer progress reports at regular intervals regarding the state and progress of Work. The details and format of the report will be mutually agreed after the award of Contract. The Contractor shall provide display boards showing progress and labour strengths at worksite. Updated project schedule in MS Projects shall also be furnished by Contractor as per agreed interval

53. Design and Engineering

- 53.1 The Work covered under this Contract having to be executed by the Contractor on a lump-sum firm price quoted by him, the Owner will not accept any proposals for changes in Value of Contract or extension in time on account of any such changes which may arise to the Contractor's scope of Work as a result of detailed Engineering and thereafter during the execution of Work.

53.2 Specifications and Drawings

- 53.2.1 The Contractor shall execute the basic and detailed design and engineering work in compliance with the provisions of the Contract, or where not so specified, in accordance with good and sound engineering practice.
- 53.2.1 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 Project Manager/ EIC 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 Owner/ Employer.

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53.3 Codes and Standards

53.3.1 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 of bid submission shall apply unless otherwise specified.

53.3.2 Approval / Review of Technical Documents by Project Manager

The Contractor shall prepare list of documents and drawings i.e. Master drawing list (MDL) as per technical specifications and furnish to the Project Manager/EIC for review & Approval of the same within 14 days from the Zero date.

53.3.3 Within ten (10) working days after receipt by the Project Manager of any document requiring the Project Manager's approval, the Project Manager 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 Project Manager proposes.

53.3.4 The Project Manager 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.

53.3.5 If the Project Manager disapproves the document, the Contractor shall modify the document and resubmit it for the Project Manager's approval. If the Project Manager 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 approved.

53.3.6 The procedure for submission of the documents by the Contractor and their approval by the Project Manager shall be as per the Contract Co-ordination procedure.

53.3.7 If any dispute or difference occurs between the Employer and the Contractor in connection with or arising out of the disapproval by the Project Manager of any document and/or any modification(s) thereto that cannot be settled between the parties within a reasonable period, then such dispute or difference may be settled in accordance with GCC Clause (Settlement of Dispute) hereof. If such dispute or difference is referred as per GCC clause, the Project Manager 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 Project Manager's instructions, provided that if the Arbitration upholds the Contractor's view on the dispute, then the Contractor shall be reimbursed by the Owner 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 Arbitration shall decide, and the Time for Completion shall be extended accordingly.

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

53.3.9 The Contractor shall not depart from any approved document unless the Contractor has first submitted to the Project Manager an amended document and obtained the Project Manager's approval thereof, pursuant to the provisions of this GCC Clause.

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53.3.10 If the Project Manager requests any change in any already approved document and/or in any document based thereon, generally shall be taken care by the Contractor if the change is not causing any major financial impact.

54. Drawings to be supplied by the Owner/Employer

54.1 The drawings attached with tender, if any, are only for the general guidance to the Contractor to enable him to visualize the type of work contemplated and scope of work involved. The Contractor will be deemed to have studied the Drawings and formed an idea about the Work involved.

54.2 The Contractor shall be deemed to have gone through the Drawings supplied to him thoroughly and carefully and in conjunction with all other connected drawings and bring to the notice of the Engineer-in-Charge/ Project Manager discrepancies, if any, therein before actually carrying out the Work.

54.3 Copies of all detailed working drawings relating to the Work shall be kept at the Contractor's office on the site and shall be made available to the Engineer-in-Charge/Project Manager at any time during the Contract. The drawings and other documents issued by the Employer/ Owner shall be returned to the Employer/ Owner on completion of the Work.

55. Drawings to be supplied by the Contractor

55.1 The drawings/ data which are to be furnished by the Contractor shall be furnished within the specified time.

55.2 Where approval/ review of drawings before manufacture/ construction/ fabrication has been specified, it shall be Contractor's responsibility to have these drawings prepared as per the TS and get it approved before proceeding with manufacture/ construction/ fabrication as the case may be. Any change that may have become necessary in these drawings during the execution of the work shall have to be carried out by the Contractor at no extra cost. All as built drawings shall bear the certification stamp duly signed by both the Contractor and Engineer-in-Charge/Project Manager.

55.3 The Drawings submitted by the Contractor shall be reviewed by the Engineer-in-Charge/Project Manager as far as practicable within 10 (Ten) working days. The Contractor shall incorporate any modifications and/ or corrections as highlighted/notified and submit the drawings for approval. Any delays arising out of failure by the Contractor to rectify the drawing in good time shall not alter the Contract Completion Time.

55.4 All GA & GFC drawings shall be provided in soft as well as Hard form in appropriate format/size to Employer for review & approval.

All as built drawings showing all corrections, adjustments & deviations, if any, etc shall be furnished by the Contractor in 04 (Four) Hard Copies & a soft copy for record purpose to the Employer/ Owner immediately after the operational acceptance.

56. Setting out Works

56.1 The Contractor shall provide, fix and be responsible for the maintenance of all stakes, templates, level marks, profiles and other similar things and shall take all necessary precautions to prevent their removal or disturbance and shall be responsible for the consequence of such removal or disturbance should the same take place and for their efficient and timely reinstatement. The Contractor shall also be responsible for the maintenance of all existing survey marks, boundary marks, distance marks and center line marks, either existing or supplied and fixed by the Contractor. Contractor shall carry out Geotech investigation at site at his own cost and design the foundations accordingly. A copy of the investigation report shall also be forwarded to Employer and Owner

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- 56.2 Before beginning the Works, the Contractor shall at his own cost, provide all necessary reference and level posts, pegs, bamboos, flags, ranging rods, strings and other materials for proper layout of the works in accordance with the schemes for bearing marks as required. The center, longitudinal or face lines and cross lines shall be marked by means of small masonry pillars. Each pillar shall have distinct mark at the center to enable theodolite to be set over it.
- 56.3 Pillars bearing geodetic marks located at the sites of units of Works under construction should be protected and fenced by the Contractor.
- 56.4 On completion of Work, the Contractor must submit the geodetic documents according to which the Work was carried out.

57. Geological Discoveries

All fossils, coins, articles of value or antiquity and structures and other remains or things of geological or archaeological interest discovered on the site where the services are performed, be deemed to be the absolute property of the Owner. The Contractor shall take reasonable precautions to prevent the personnel or any other persons from removing or damaging any such article or thing and shall immediately upon the discovery thereof and, before removal, acquaint the Owner of such discovery any carry out, at the expense of the Owner, the Owner's orders as to the disposal of the same.

58. Materials to be supplied by Contractor

58.1 Plant and Equipment

The Contractor shall procure and transport all the Plant and Equipment in an expeditious and orderly manner to the Site to achieve completion of activities as per schedule to enable commissioning of the Project by the scheduled commissioning date. Contractor shall deliver supplies at site in accordance to its erection sequence. Owner may hold payment against supplies in case same is delivered more than 03 (Three) months before its erection requirement (except for imported items)

58.2 Transportation

The Contractor shall ensure that all the plant and equipment required to complete the Facility at site, are procured and dispatched. 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. Contractor shall be responsible to assess in advance suitability of access roads, bridges, culverts, etc for transportation of ODC shipments, if any and arrange to transport them accordingly.

58.3 Packing and Marking

The Contractor shall be responsible for securely protecting and packing the plant & equipment as per prescribed standards in force to withstand the journey and ensuring safety of materials and also arrival of materials at destination in original condition and good for contemplated use. Packing case size & weight shall take into consideration the remoteness of the goods final destination and absence of heavy material handling facilities at all points in transit.

Packing lists of materials shall be provided in each package to facilitate checking up of the contents at the destination.

In order to import any items, associated with the Solar PV Power Project, from abroad or from any other state in India, Contractor shall have to arrange any clearance, permission, if required at his own risk, from any Government (Government of State & Government of India) or any Government (Government of State & Government of India) controlled organization for transportation of materials

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from manufacturing shop to delivery at Site. Contractor shall take necessary insurances to ensure safe transit & consequential risks. All packing material is the property of the Owner and shall be immediately taken into the safe storage.

58.4 Storage of Equipment

The plant and equipment thus procured under the scope of the contract must be kept in safe custody till put under operation, essentially free from water contact. All the spares, as required for the trouble-free comprehensive O&M of Plant, must be kept under secure storage during O&M period. Contractor has to ensure the appropriate and proper storage arrangement prior to the arrival of the equipment including containers, temporary structures, sheds, platforms etc at its own cost.

The Contractor shall procure and provide within the Value of Contract the whole of the materials required for the construction including steels, cement and other building materials, tools, tackles, construction plant and equipment for the completion and maintenance of the Work except the materials which will be issued by the Owner and shall make his own arrangement for procuring such materials and for the transport thereof. The Owner may give necessary recommendation to the respective authority if so desired by the Contractor but assumes no further responsibility of any nature. The Owner will insist on the procurement of materials which bear ISI stamp and/ or which are supplied by reputed suppliers.

- 58.5 The Contractor shall properly store all materials either issued to him or brought by him to the Site to prevent damages due to rain, wind, direct exposure to sun, etc. as also from theft, pilferage, etc. for proper and speedy execution of his works. The Contractor shall maintain sufficient stocks of all materials required by him including commissioning spares.

59. Stores Supplied by the Owner

- 59.1 If the Specification of the Work provides for the use of any material of special description to be supplied from the Owner's stores or it is required that the Contractor shall use certain stores to be provided by the Owner, such materials and stores, there for as hereinafter mentioned being so far as practicable for the convenience of the Contractor, but not so as in any way to control the meaning or effect of the Contract, the Contractor shall be bound to purchase and shall be supplied such materials and stores as are from time to time required to be used by him for the purpose of the Contract only. After the completion of the Work, however, the Contractor has to account for the full quantity of materials supplied to him as per relevant clauses in this document.

- 59.2 All materials so supplied to the Contractor shall remain the absolute property of the Owner and shall not be removed on any account from the Site of the Work and shall be at all times open for inspection to the Engineer-in-Charge/Project Manager. Any such materials remaining unused at the time of the completion or termination of the Contract shall be returned to the Owner's stores or at a place as directed by the Engineer-in-Charge/Project Manager in perfectly good condition at Contractor's cost.

- 59.3 Owner, at his sole discretion and upon request from Contractor, may provide appropriate space for storage outside the site on chargeable basis mutually agreeable to both parties. However, the transportation of equipment from store to site shall be arranged by the Contractor at his cost and risk

60. Conditions for Issue of Materials

- 60.1 i) Materials specified as to be issued by the Owner will be supplied to the Contractor by the Owner from his stores. It shall be responsibility of the Contractor to take delivery of the materials and arrange for its loading, transport and unloading at the Site of Work at his own cost. The materials shall be issued between the working hours and as per the rules of the Owner as framed from time

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to time. Once the material is issued or taken over by the Contractor, then the same will be his own liability to store, use & maintain.

ii) The Contractor shall bear all incidental charges for the storage and safe custody of materials at site after these have been issued to him.

iii) Materials specified as to be issued by the Owner shall be issued in standard sizes as obtained from the manufacturers.

iv) The Contractor shall construct suitable godowns at the Site of Work for storing the materials safe against damage by rain, dampness, fire, theft etc. He shall also employ necessary watch and ward along with proper illumination establishment for the purpose.

v) It shall be duty of the Contractor to inspect the materials supplied to him at the time of taking delivery and satisfy himself that they are in good condition. After the materials have been delivered by the Owner, it shall be the responsibility of the Contractor to keep them in good condition and if the materials are damaged or lost, at any time, they shall be repaired and/ or replaced by him at his own cost.

vi) The Owner shall not be liable for delay in supply or non-supply of any materials which the Owner has undertaken to supply where such failure or delay is due to natural calamities, act of enemies, transport and procurement difficulties and any circumstances beyond the control of the Owner. In no case, the Contractor shall be entitled to claim any compensation or loss suffered by him on this account.

vii) It shall be responsibility of the Contractor to arrange in time all materials required for the Work other than those to be supplied by the Owner. If, however, in the opinion of the Engineer-in-Charge/Project Manager the execution of the Work is likely to be delayed due to the Contractor's inability to make arrangements for supply of materials which normally he has to arrange for, the Engineer-in-Charge/Project Manager shall have the right at his own discretion to issue such materials, if available with the Owner or procure the materials from the market or as elsewhere and the Contractor will be bound to take such materials at the rates decided by the Engineer-in-Charge/Project Manager. This, however, does not in any way absolve the Contractor from responsibility of making arrangements for the supply of such materials in part or in full, should such a situation occur nor shall such action by Owner constitute a reason for the delay in the execution of the Work.

viii) The Contractor shall, if desired by the Engineer-in-Charge/Project Manager, be required to execute an Indemnity Bond in the prescribed form for safe custody and accounting of all materials issued by the Owner.

ix) The Contractor shall furnish to the Engineer-in-Charge/Project Manager sufficiently in advance a statement showing his requirement of the quantities of the materials to be supplied by the Owner and the time when the same will be required by him for the works, so as to enable the Engineer-in-Charge/Project Manager to make necessary arrangements for procurement and supply of the material.

x) Account of the materials issued by the Owner shall be maintained by Contractor indicating the daily receipt, consumption and balance in hand. This account shall be maintained in a manner prescribed by the Engineer-in-Charge/Project Manager along with all connected papers viz. requisitions, issues, etc., and shall be always available for inspection in the Contractor's office at Site.

xi) The Contractor should see that only the required quantities of materials are got issued. The Contractor shall not be entitled to cartage and incidental charges for returning the surplus materials, if any, to the stores wherefrom they were issued.

xii) Materials/ Equipment(s) supplied by Employer/ Owner shall not be utilized for any purpose(s) than issued for.

61. Material Procured with Assistance of Owner/ Return of Surplus

61.1 Notwithstanding anything contained to the contrary in any or all the clauses of this Contract where any materials for the execution of the Contract are procured with the assistance of the Owner either by issue from Owner's stock or purchases made under order or permits or licenses issued by Government, the Contractor shall hold the said materials as trustee for the Owner and use such materials economically and solely for the purpose of the Contract and not dispose them off without the permission of the Owner and return, if required by the Engineer-in-Charge/Project Manager, shall determine having due regard to the condition of the materials.

62. Materials obtained from Dismantling

62.1 If the Contractor in the course of execution of the Work is called upon to dismantle any part for reasons other than those stipulated in Clauses 67 and 70 hereunder, the materials obtained in the Work of dismantling etc., will be considered as the Owner's property and will be disposed off to the best advantage of the Owner.

63. Articles of Value Found

63.1 All gold, silver and other minerals of any description and all precious stones, coins, treasure relics, antiquities and other similar things which shall be found in, under or upon the Site, shall be the property of the Owner and the Contractor shall duly preserve the same and shall from time to time deliver the same to such person or persons indicated by the Owner.

64. Discrepancies between Instructions

64.1 Should any discrepancy occur between the various instructions furnished to the Contractor, his representative or staff or any doubt arises as to the meaning of any such instructions or should there be any misunderstanding between the Contractor's staff and the Engineer-in-Charge/Project Manager's staff, the Contractor shall refer the matter immediately in writing to the Engineer-in-Charge/Project Manager whose decision thereon shall be final and conclusive and no claim for losses alleged to have been caused by such discrepancies between instructions, doubts, or misunderstanding shall in any event be admissible.

65. Action where no Specification is issued

65.1 In case of any class of Work for which there is no Specification supplied by the Employer/ Owner as mentioned in the Tender Documents such Work shall be carried out in accordance with Indian Standard Specifications and if the Indian Standard Specifications do not cover the same, the Work should be carried out as per standard Engineering Practice subject to the approval of the Engineer-in-Charge/Project Manager.

66. Inspection of Works

66.1 The Engineer-in-Charge/Project Manager will have full power and authority to inspect the Work at any time wherever in progress either on the Site or at the Contractor's premises/ workshops wherever situated, premises/ workshops of any person, firm or corporation where Work in connection with the Contract may be in hand or where materials are being or are to be supplied, and the Contractor shall afford or procure for the Engineer-in-Charge/Project Manager every facility and assistance to carry out such inspection. The Contractor shall, at all time during the usual working hours and at all other time at which reasonable notice of the intention of the Engineer-in-Charge/Project Manager or his representative to visit the Work shall have been given to the

Contractor, either himself be present or receive orders and instructions, or have a responsible representative duly accredited in writing, present for the purpose. Orders given to the Contractor's representative shall be considered to have the same force as if they had been given to the Contractor himself. The Contractor shall give not less than 15 (Fifteen) day notice in writing to the Engineer-in-Charge/Project Manager for carrying out the inspection, Domestic or Overseas) so as to reach out for the inspection by the concerned officials and/or measurement of any work in order that the same may be inspected and measured. Employer/Owner at his own discretion may or may not attend the scheduled inspection calls as arranged by the contractor on account of pre-occupation and other site exigencies.

In the event of breach of above the same shall be uncovered at Contractor's expense for carrying out such measurement or inspection.

- 66.2 The Contractor is to provide at all time during the progress of the Work and the maintenance period, proper means of access with ladders, gangways etc. to move and adopt as directed for inspection or measurements of the Work by the Engineer-in-Charge/Project Manager.
- 66.3 The Contractor shall make available to the Engineer-in-Charge/Project Manager free of cost all necessary instruments and assistance in checking or setting out of Work and in the checking of any Work made by the Contractor for the purpose of setting out and taking measurements of Work.

67. Tests for Quality of Work

- 67.1 All workmanship shall be of the respective kinds described in the Contract Documents and in accordance with the instructions of the Engineer-in-Charge/Project Manager and shall be subjected from time to time to such test as the Engineer-in-Charge/Project Manager may direct at the place of manufacture or fabrication or on the site or at all or any such places.

The cost of inspection/ pre-dispatch inspection/ in-stage inspection (Exclusive of Employer/ Owners representatives TA/DA) shall be borne by Contractor. Such pre-dispatch inspection(s) at the manufacturer's facility shall be carried out in the presence of the Employer/Owner or their authorized representatives, for such items as is specified by the Engineer-in-Charge/Project Manager. Travel expenses for the representatives of Employer/Owner for such inspections shall be borne by the Employer/Owner respectively.

However, in case re-inspection is necessitated on account of non-acceptance of item(s) due to failure on Factory Acceptance Test(s), the cost of associated travel and accommodation for the revisit shall be borne by the Contractor. A minimum of 07 (Days) notice shall be given by the Contractor for witnessing such inspection at the works

The Contractor shall provide assistance, instruments, labour and materials as are normally required for examining, measuring and testing any workmanship as may be selected and required by the Engineer-in-Charge/Project Manager and keep all stage inspection/ material TC readily available for the Inspector.

- 67.2 All the tests that will be necessary in connection with the execution of the Work as decided by the Engineer-in-Charge/Project Manager shall be carried out at the field-testing laboratory of the Owner by paying the charges as decided by the Owner from time to time. In case of non-availability of testing facility with the Owner, the required test shall be carried out at the cost of Contractor at Government or any other accredited testing laboratory.
- 67.3 If any tests are required to be carried out in conjunction with the Work or materials or workmanship not supplied by the Contractor, such tests shall be carried out by the Contractor and cost of such tests shall be reimbursed by the Owner.

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67.4 The PV modules/ inverters/ cables and other Balance of system equipment deployed in the solar PV power Plant shall have valid test certificates for their qualification as per above specified IEC/ IS Standards by one of the NABL Accredited /Govt approved Test Centers in India. In case of module types/ equipment for which such Test facilities may not exist in India, test certificates from reputed ILAC Member body accredited Labs abroad (with proof of accreditation) will be acceptable.

68. Samples for Approval

68.1 In case of requirement, the Contractor shall furnish to the Engineer-in-Charge/Project Manager for approval, when requested or if required by the specifications, adequate samples of all materials and finished to be used in the Work. Such samples shall be submitted before the Work is commenced and in ample time to permit tests and examinations thereof. All materials furnished and finishes applied in actual Work shall be fully equal to the approved samples.

69. Action and Compensation in case of Poor/Non-compliant Work

69.1 If, against documentary proofs, is established that any work has been executed with unsound, imperfect or unskilled workmanship, or with materials of any inferior description, or that any materials or articles provided by the Contractor for the execution of the Work are unsound, or of a quality inferior to that contracted for, or otherwise not in accordance with the Contract, the Contractor shall on demand in writing from the Engineer-in-Charge/Project Manager or his authorized representative specifying the Work, materials or articles complained of notwithstanding that the same may have been inadvertently passed, certified and paid for, forthwith rectify or remove and reconstruct the Work so specified and provide other proper and suitable materials or articles at his own cost. In the case of any such failure the Engineer-in-Charge/Project Manager may on expiry of notice period rectify or remove and re-execute the Work or remove and replaced with others, the materials or articles complained of to as the case may be at the risk and expense in all respects of the Contractor. The decision of the Engineer-in-Charge/Project Manager as to any question arising under this clause shall be final and conclusive. No additional time for Project completion shall be granted for undertaking such replacement/ rectification works by Contractor.

70. Suspension of Works

70.1 i) Subject to the provisions of sub-para (ii) of this clause, the Contractor shall, if ordered in writing by the Engineer-in-Charge/Project Manager, or his representative, temporarily suspend the Works or any part thereof for such written order, proceed with the Work therein ordered to be suspended until, he shall have received a written order to proceed therewith. The Contractor shall not be entitled to claim compensation for any loss or damage sustained by him by reason of temporary suspension of the Works aforesaid. However, suitable time extension may be considered at the sole discretion of the owner.

ii) In case of suspensions of entire Work, ordered in writing by Engineer-in-Charge/Project Manager, for a period of more than 03 (Three) months, the Contractor shall have the option to terminate the Contract.

71. Owner may do Part of Work

71.1 Upon failure of the Contractor to comply with any instructions given in accordance with the provisions of this Contract the Owner has the alternative right, instead of assuming charge of entire Work, to place additional labour force, tools, equipment and materials on such parts of the Work, as the Owner may designate or also engage another Contractor to carry out the Work. In such cases, the Owner shall deduct from the amount which otherwise might become due to the Contractor, the cost of such work and material with 110% (Hundred & Ten Percent) of the actual cost of works and materials.

72. Possession prior to Completion

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72.1 The Engineer-in-Charge/Project Manager shall have the right to take possession of or use any completed or partially completed Work or part of the Work. Such possession or use shall not be deemed to be an acceptance of any work completed in accordance with the Contract Agreement. If such prior possession or use by the Engineer-in-Charge/Project Manager delays the progress of Work, equitable adjustment in the time of completion will be made and the Contract Agreement shall be deemed to be modified accordingly.

73. Defects Liability Period

[12 (Twelve) Months Period of Liability from the date of Operational Acceptance]

73.1 The Contractor must warrant that the Facilities shall be free from defects in the design, engineering, materials and workmanship of the Plant and Equipment supplied and of the work executed.

73.2 If it shall appear to the Project Manager that any supplies have been executed with unsound, imperfect or unskilled workmanship, or with materials of any inferior description, or that any materials or articles provided by the Contractor for the execution of Contractor are unsound or otherwise not in accordance with the Contract, the Contractor shall on demand in writing inform the Project Manager or its authorized representative specifying the item, materials or articles complained of, notwithstanding that the same may have been inadvertently passed, certified and paid for. The Contractor shall forthwith rectify or remove and replace that item so specified and provide other proper and suitable materials or articles at its own charge and cost, and in the event of failure to do so within a period to be specified by the Project Manager in its demand aforesaid, the Project Manager may on expiry of notice period rectify or remove and re-execute the time or remove and replace with others, the materials or articles complained of as the case may be at the risk and expense in all respects of the Contractor. The decisions of the Project Manager in this regard shall be final and binding.

73.3 The Contractor shall also be undertaking the operation and maintenance of the Facility and consequently shall be required to rectify any defects that emerge during the operation of the Facilities for the entire term of this Contract.

73.4 The Defect Liability Period shall be of twelve (12) months from the date of Operation Acceptance, during which the Contractor must repair any defect identified by the Project Manager / EIC after commissioning of the Plant. All the expenses to repair the defects shall be borne by the Contractor and no additional cost charged to the Owner.

73.5 If during the Defect Liability Period any defect should be 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 Owner 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.

73.6 Furthermore, without prejudice to the generality of the foregoing, it is clarified that the Contractor shall also be responsible for the repair, replacement or making good of any defect, or of any damage to the Facilities arising out of or resulting from any of the following causes:

- Improper operation or maintenance of the Facilities by the Contractor during operation and maintenance of the Facility; and
- Operation of the Facilities outside specifications of the Facilities.

73.7 The Contractor may, with the consent of the Owner, remove any Plant and Equipment or any part of the Facilities that are defective from the Site, 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.

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- 73.8 If the repair, replacement or making good is of such a nature that it may affect the efficiency of the Facilities or any part thereof, the Owner 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.
- 73.9 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 inferior to what has already been agreed upon by the Owner and the Contractor for the original equipment/part of the Facilities.
- 73.10 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 less than seven (7) days), the Owner may, following a notice to the Contractor, proceed to do such work, and the costs incurred by the Owner in connection therewith shall be paid to the Owner by the Contractor or may be deducted by the Owner from any monies due to the Contractor or claimed under the Performance Guarantee, without prejudice to other rights, which the Owner may have against the Contractor in respect of such defects.
- 73.11 If the Facilities or any part thereof cannot be used by reason of such defect and/or making good of such defect, the Defect Liability Period of the Facilities or such part, as the case may be, shall be extended by a period equal to the period during which the Facilities or such part cannot be used by the Owner because of any of the aforesaid reasons. Upon correction of the defects in the Facilities or any part thereof by repair/replacement, such repair/replacement shall have the defect liability period of twelve (12) months from such replacement.
- 73.12 In addition, the Contractor shall also provide an extended warranty for any such component of the Facilities and for the period of time. Such obligation shall be in addition to the defect liability specified.
- 73.13 Latent defect liability: Notwithstanding, the defect liability period of 12 months above, the plant shall carry a latent defect liability of 5 years from date of operational acceptance towards any design/manufacturing defects in the equipment supplied by the Contractor
- 73.14 The Contractor's liability under this contract for any reason, what so ever, shall be limited to the total Contract Price (Including GST etc)

73.15 Limitation of Liability

Notwithstanding anything contrary contained herein, the aggregate total liability of Contractor under the Agreement or otherwise shall be limited to **100% of Agreement/ Contract Value** except in case of Patent Infringement liability. However, neither party shall be liable to the other party for any indirect and consequential damages, loss of profits or loss of production.

73.16 Guarantee/ Warranty

As enumerated in Clause no. 73 (Defect Liability Period) of GCC, the overall DLP should stand valid for a period of 12 (Twelve) Months from the date of Operational Acceptance. However, Contractor needs to ensure following Guarantees/ Warranties to the best possible extent for the successful execution of the Contract. Subsequently, necessary Guarantee/ Warranty Certificate shall be produced by the Contractor prior to Operational Acceptance of the Facility.

Guarantee/ Warranty as defined under Section VII, Scope of work and Technical specifications will prevail in this clause. Contractor should guarantee the Plant facility for the workmanship for a period of 05 (Five) years from the date of Operational Acceptance.

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73.16.1 The Contractor must ensure that the goods supplied under the Contract are new, unused and of most recent or current models and incorporate all recent improvements in design and materials unless provided otherwise in the Contract.

73.16.2 The Contractor shall transfer the warranty/ guarantees of the equipment as such from the OEM/ supplier in the name of the Owner. The period of the warranty / guarantee for each equipment shall be as per the "Technical Specifications"

73.16.3 During the period of Warranty / Guarantee the Contractor shall remain liable to replace any defective parts, that becomes defective in the plant, of its own manufacture or that of its sub-Contractors, under the conditions provided for by the Contract under and arising solely from faulty design, materials or workmanship & faulty operation/repair, provided such defective parts are not repairable at Site. After replacement, the Contractor is allowed to take back the defective parts to its works at his expenses.

73.16.4 At the end of warranty/ guarantee period, the Contractor's liability shall cease subjected to fulfillment of its liability under GCC Clause 73.16 (Defect Liability Period). In respect of goods not mentioned for the warranty/ guarantee in "Technical Specifications", the Owner shall be entitled to the benefit of such guarantee given to the Contractor by the original Supplier or manufacturer of such goods eg Performance guarantee for 25 yrs for modules, etc.

73.16.5 During the Comprehensive Operation & Maintenance period, the Contractor shall be responsible for any defects in the work due to faulty workmanship or due to use of sub-standard materials in the work. Any defects in the work during the guarantee period shall therefore, be rectified by the Contractor without any extra cost to the Owner within a reasonable time as may be considered from the date of receipt of such intimation from the Owner failing which the Owner reserves the right to take up rectification work at the risk and cost of the Contractor.

74. Care of Works

74.0 From the commencement to completion of the Work & till the completion of O&M period (If applicable), the Contractor shall take full responsibility for the care for all works including all temporary works and in case any damages, loss or injury shall happen to the Work or to any part thereof or to any temporary works from any cause whatsoever, shall at his own cost repair and make good the same so that at completion the Work shall be in good order and in conformity in every respects with the requirement of the Contract and the Engineer-in- Charge's instructions. Also damage to external property of Third Parties.

74.1 Defects Prior to Taking Over

If at any time, before the Work is taken over, the Engineer-in-Charge/Project Manager shall:

a) Decide that any works done or materials used by the Contractor or by any Sub-Contractor is defective or not in accordance with the Contract, or that the works or any portion thereof are defective, or do not fulfill the requirements of Contract (all such matters being hereinafter, called 'Defects' in this clause), and

b) As soon as reasonably practicable, gives to the Contractor notice in writing of the said decision, specifying particulars of the defects alleged to exist or to have occurred, then the Contractor shall at his own expenses and with all speed make good the defects so specified.

In case, Contractor shall fail to do so, the Owner may take, at the cost of the Contractor, such steps as may take in all circumstances, be reasonable to make good such defects. The expenditure so incurred by the Owner will be recovered from the amount due to the Contractor. The decision taken by the Owner in this regard towards the amount to be recovered from the Contractor will be final

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and binding on the Contractor. As soon as the Work has been completed in accordance with the Contract (except in minor respects that do not affect their use for the purpose for which they are intended and have passed the tests on completion, the Owner shall be deemed to have taken over the Work on the date so certified.

74.2 Defects after Taking Over (If applicable)

In order that the Contractor could obtain a Completion he shall make good, with all possible speed, any defect arising from the defective materials supplied by the Contractor or workmanship or any act or omission of the Contract or that may have been noticed or developed, after the works has been taken over, the period allowed for carrying out such Work will be normally 01 (One) Month. If any defect be not remedied within a reasonable time, the Owner may proceed to do the Work at Contractor's risk and expense and deduct from the final bill such amount as may be decided by the Owner. If by reason of any default on the part of the Contractor a Completion has not been obtained in respect of any portion of the Work within 01 (One) Month after the date fixed by the Contract for the completion of the Work, the Owner shall be at liberty to use the Work or any portion thereof in respect of which a completion has not been obtained, provided that the Work or the portion thereof so used as aforesaid shall be afforded reasonable opportunity for completing these works for the Completion .

75. Guarantee/ Transfer of Guarantee

For the major Material/Products/Spares of the works & Projects including but not limited to PV Modules, Power Conditioning Units (PCU)/ Inverters, Transformers, Batteries (If applicable) etc the Contractor shall invariably engage OEMs/Sub-Contractors who are specialists in the field and OEM's/OPM's/firms of repute and such a OEM/OPM/Sub-Contractor shall furnish guarantees/warranties for their workmanship to the Owner directly in the name of Owner only without any deviation. The Contractor shall give the guarantee/warranty to the Owner directly For other minor Material/Products/Spares also.

In case of the contract termination/cancellation and wherein the title of Guarantee/Warranty for the major Material/Products/Spares of the works & Projects including but not limited to PV Modules, Power Conditioning Units (PCU)/ Inverters, Transformers, Batteries (If applicable) is in the name of the Contractor, then all such Guarantee/Warranties for all such major products/material/spares will have to be mandatorily transferred in the name of Owner as soon as the contract is terminated/cancelled & no plea/deviation from the Contractor side will be entertained in this regard.

For works like water-proofing, acid and alkali resisting materials, pre-construction soil treatment against termite or any other specialized works etc. the Contractor shall invariably engage Sub-Contractors who are specialists in the field and firms of repute and such a Sub-Contractor shall furnish guarantees for their workmanship to the Owner, through the Contractor. In case such a Sub-Contractor is not prepared to furnish a guarantee to the Owner, the Contractor shall give that guarantee to the Owner directly.

76. Installation and Training of Employer's/ Owner's Personnel

76.1 Tools & Tackles

The Contractor shall provide technically suitable tools and tackles for installation & erection of Plant & Machineries conforming to relevant BIS safety and technical standards for proper execution of work. The Owner, in no way, shall be responsible for supply of any tools and tackles for implementation of the work and also to carry out operation & maintenance activities.

76.2 Setting up/Supervision/Labor

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76.2.1 Bench Mark:

The Contractor shall be responsible for the true and proper setting-up of the Facilities in relation to bench marks, reference marks which are mutually agreed upon by the Contractor and Owner.

If, at any time during the progress of installation of the Facilities, any error shall appear in the position, level or alignment of the Facilities, the Contractor shall forthwith notify the Project Manager of such error and, at its own expense, immediately rectify such error.

76.2.2 Contractor's Supervision:

The Contractor shall give or provide all necessary supervision during the installation of the Facilities, and the Construction Manager or its deputy shall be constantly on the Site to provide full-time supervision of the installation. The Contractor shall provide and employ only technical personnel who are skilled and experienced in their respective fields and supervisory staff who are competent to adequately supervise the work at hand.

76.2.3 Labour:

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

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

The Contractor shall be responsible for obtaining all necessary permit(s) and/or visa(s) from the appropriate authorities for the engagement and entry of all labour and personnel to be employed by Contractor on the Site including that of his sub-Contractors.

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.

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 labor.

The Contractor shall keep the Owner indemnify, during construction as well as during O&M period, in respect of compliance with the statutory provisions in respect to the labor employed at site.

Upon completion of the construction activities/ O&M activities, the Contractor shall obtain no – objection certificate (NOC) from local/ statutory bodies in respect to the fulfillment of all compliance and submit a copy to the Owner prior to the final settlement

76.3 Contractor's Equipment

76.3.1 All equipment brought by the Contractor onto the Site shall be deemed to be intended to be used exclusively for the execution of the Contract. The Contractor shall not remove the same from the Site without the Project Manager's consent that such Contractor's Equipment is no longer required for the execution of the Contract.

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All the necessary approvals with due taxes, insurance and license, as required for the use of equipment at site, are to be taken by the Contractor.

The equipment should be in a good operating condition for safe use at site. The operator shall be competent to operate. It is advised to keep adequate spares, consumables, etc to reduce the breakdown time.

76.3.2 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.

76.4 Site Regulations and Safety

Contractor shall submit the EHS policy for the site to the Project Manager/EIC within 14 (fourteen) days from effective date and shall abide by the rules and regulations of the EHS policy.

The Contractor shall have to provide necessary and adequate safety measures including personal protective equipment and precautions to avoid any accident, which may cause damage to any equipment / material or injury to workmen. The Owner shall not be liable for any such accidents during the performance of the contract.

The Contractor, if required, will provide necessary safety training to workmen. Also, Contractor shall engage sufficient security guards to protect Facility from any theft and unauthorized access to site during the entire construction and O&M periods.

76.5 Site Clearance

76.5.1 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, packaging material, rubbish & debris and temporary installations from the Site, and remove any Contractor's Equipment no longer required for execution of the Contract with due approval of the Owner.

76.5.2 Site Clearance after Completion

After Completion of all parts of the Facilities, the Contractor shall clear away and remove all wreckage, packaging material, rubbish & debris and temporary works & installations of any kind from the Site with due approval of the Owner and shall leave the Site and Facilities clean and safe.

76.5.3 Disposal of Scrap

The term 'Scrap' shall refer to scrap/ waste/ remnants arising out of the unpacking of equipment, construction debris, breakage of modules, fabrication of structural steel work and piping work at the project site in the course of execution of the contract and shall also include any wastage of cables during the termination process while installing the cables.

The Contractor shall with the agreement of the Owner promptly remove from the site any 'Scrap' generated during Performance of any activities at site in pursuance of the Contract.

The disposal of such Scrap shall vest with the Contractor for the items supplied by the Contractor and issued by Owner under this contract for installation and construction without any additional cost to the Owner. The removal of scrap shall be subject to the due approval of Owner & Contractor producing the necessary clearance from the relevant authorities, if required by the law, in respect of

disposal of the scrap. The liability for the payment of the applicable GST shall be that of the Contractor.

The Contractor shall also indemnify to keep the Owner harmless from any act of omission or negligence on the part of the Contractor in following the statutory requirements with regard to removal/disposal of scrap. The undertaking shall be furnished by Contractor as per Format enclosed in the Section VI of Forms & Formats. Further, in case the laws require the Owner to take prior permission of the relevant Authorities before handing over the scrap to the Contractor, the same shall be obtained by the Contractor on behalf of the Owner.

In case, the scrap is generated against the free issue material supplied by the Owner, the Contractor shall maintain a separate record of same and intimate Owner before its disposal thereafter. After due approval from Owner, the scrap should be disposed of and its value shall be remitted to the Owner.

76.5.4 Watch & Ward and Lighting

The Contractor shall provide and maintain at its own expense all lighting, fencing, watch and ward wherever necessary for the proper execution and the protection of the Facilities, or for the safety of the Owners and occupiers of adjacent property and for the safety of the public during the entire construction and O&M period.

76.6 Training

The period and the nature of training for the individual personnel shall be agreed upon mutually between the Contractor and the Owner. These personnel shall be given special training at the shops, where the equipment will be manufactured and/ or in their collaborator's works and where possible, in any other plant where equipment manufactured by the Contractor or his collaborators is under installation or test to enable those personnel to become familiar with the equipment being furnished by the Contractor. Owner shall bear the cost of Boarding, Lodging & Travel only for the said personnels.

The Contractor undertakes to provide training to Personnel selected and sent by the Owner at the works of the Contractor without any cost to the Owner.

77. Replacement of Defective Parts and Materials

- 77.1 If during the progress of the Work, Owner shall decide and inform in writing to the Contractor, that the Contractor has manufactured any plant or part of the plant unsound or imperfect or has furnished plant inferior to the quality specified, the Contractor on receiving details of such defects or deficiencies shall at his own expenses within 07 (Seven) days of his receiving the notice, or otherwise within such time as may be reasonably necessary for making it good, proceed to alter, re-construct or remove such work and furnish fresh equipment's up to the standards of the specifications.

In case the Contractor fails to do so, Owner may on giving the Contractor 07 (Seven) day notice in writing of his intentions to do so, proceed to remove the portion of the Work so complained of and at the cost of Contractor's, perform all such works or furnish all such equipment's provided that nothing in the clause shall be deemed to deprive the Owner of or affect any rights under the Contract, the Owner may otherwise have in respect of such defects and deficiencies.

78. Indemnity

- 78.1 If any action is brought before a Court, Tribunal or any other Authority against the Employer/ Owner or an officer or agent of the Employer/ Owner, for the failure, omission or neglect on the part of the

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Contractor to perform any acts, matters, covenants or things under the Contract, or damage or injury or death caused by the alleged omission or negligence on the part of the Contractor, his agents, representatives or his Sub-Contractor's, or in connection with any claim based on lawful demands of Sub-Contractor's workmen suppliers or employees, the Contractor, shall in such cases indemnify and keep the Employer/ Owner and/ or their representatives harmless from all losses, damages, expenses or decrees arising out of such action.

79. Construction Aids, Equipment, Tools & Tackles

- 79.1 Contractor shall be solely responsible for making available for executing the Work, all requisite Construction Equipments, Special Aids, Barges, Cranes and the like, all Tools, Tackles and Testing Equipment and Appliances, including imports & insurance of such equipment etc. as required. In case of import of the same the rates applicable for levying of Custom Duty on such Equipment, Tools & Tackles and the duty drawback applicable thereon shall be ascertained by the Contractor from the concerned authorities of Government of India. It shall be clearly understood that Owner shall not in any way be responsible for arranging to obtain Custom Clearance and/ or payment of any duties and/ or duty draw backs, license etc. for such equipment's so imported by the Contractor and the Contractor shall be fully responsible for Goods and Service Tax (GST) and documentation with regard to the same. Bidder in his own interest may contact, for any clarifications in the matter, concerned agencies/ Dept./ Ministries of Govt. of India. All clarifications so obtained and interpretations thereof shall be solely the responsibility of the Contractor.

[F] CERTIFICATES AND PAYMENTS

80. Schedule of Rates and Payments

80.1 Contractor's Remuneration

For EPC/ Lumpsum Turnkey Contracts, the billing procedure will follow as per the prescribed payment terms as defined in Special Conditions of Contract (SCC). The price to be paid by the Owner to Contractor for the whole of the Work to be done and for the performance of all the obligations undertaken by the Contractor under the Contract Documents shall be ascertained by the application of the respective Schedule of Rates (the inclusive nature of which is more particularly defined by way of application but not of limitation, with the succeeding Clause of this clause) and payment to be made accordingly for the Work actually executed and approved by the Engineer-in-Charge/Project Manager. The sum so ascertained shall (excepting only as and to the extent expressly provided herein) constitute the sole and inclusive remuneration of the Contractor under the Contract and no further or other payment whatsoever shall be or become due or payable to the Contractor under the Contract.

80.2 Schedule of Rates to be Inclusive

The prices quoted by the Contractor shall remain firm till the contract period and shall not be subject to escalation. Schedule of Rates shall be deemed to include and cover all costs, expenses and liabilities of every description and all risks of every kind to be taken in executing, completing and handing over the Work to the Owner by the Contractor. The Contractor shall be deemed to have known the nature, scope, magnitude and the extent of the Work and materials required though the Contract Document may not fully and precisely furnish them. Bidders in the Schedule of Rates should cover all costs as he may consider necessary to cover the cost of any works and materials as may be reasonable and necessary to complete the Work. Generality of this present provision shall not be deemed to cut down or limit in any way because in certain cases it may and in other cases it may not be expressly stated that the Contractor shall do or perform a work or supply articles or perform services at his own cost or without addition of payment or without extra charge or words to the same effect or that it may be stated or not stated that the same are included in and covered by the Schedule of Rates.

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80.3 Schedule of Rates to Cover Construction Equipments, Materials, Labour etc.

Without in any way limiting the provisions of the preceding Clause the Schedule of Rates shall be deemed to include and cover the cost of all construction equipment, temporary Work (except as provided for herein), pumps, materials, labour, insurance, fuel, consumables, stores and appliances to be supplied by the Contractor and all other matters in connection with each item in the Schedule of Rates and the execution of the Work or any portion thereof finished, complete in every respect and maintained as shown or described in the Contract Documents or as may be ordered in writing during the continuance of the Contract.

80.4 Schedule of Rates to Cover Royalties, Rents and Claims

The Schedule of Rates (i.e., Contract Value) shall be deemed to include and cover the cost of all Royalties and Fees for the articles and processes, protected by letters, patent or otherwise incorporated in or used in connection with the Work, also all Royalties, Rents and other payments in connection with obtaining materials of whatsoever kind for the Work and shall include an Indemnity to the Employer/ Owner which the Contractor hereby gives against all actions, proceedings, claims, damages, costs and expenses arising from the incorporation in or use on the Work of any such articles, processes or materials, other municipal or local Board Charges, if levied on materials, equipment or machineries to be brought to site for use on Work shall be borne by the Contractor.

80.5 Schedule of Rates to Cover GST/Applicable taxes

No exemption or reduction of Duties, Goods & Service Tax (GST) on Works Contract quay or any port dues, transport charges, stamp duties or Central or State Government or Local Body or Municipal Taxes or from or of any other body, whatsoever, will be granted or obtained, all of which expenses shall be deemed to be included in and covered by the Schedule of Rates. The Contractor shall also obtain and pay for all permits or other privileges necessary to complete the Work.

80.6 Schedule of Rates to Cover Risks of Delay

The Schedule of Rates shall be deemed to include and cover the risk of all possibilities of delay and interference with the Contractor's conduct of Work which occur from any causes including orders of the Employer/ Owner in the exercise of his power and on account of extension of time granted due to various reasons and for all other possible or probable causes of delay.

80.7 Schedule of Rates Cannot be altered

- (a) For Engineering, Procurement and Commissioning (EPC) Contracts or Lumpsum Turnkey (LSTK) Contracts, the total Project/ Contract Value stands to be fixed inclusive of entire items, Materials, Spares, Consumables, Services, Erection and all quoted and unquoted items/ Services in the Bill of Quantity (BOQ) of the Tender/ Contract. Contract Value of such EPC Contracts comprises of all the related costs required for successful execution of the work. The final payment outlay or total cost of the project will be limited to the total value of the EPC Contract and O & M Contract. Any kind of variations related to Total Contract Value shall be to Contractor's account. The payment will be made according to the Work carried out, for which purpose an item wise, or work wise Schedule of Rates shall be furnished, suitable for evaluating the value of Work done and preparing running account bill.
- (b) If applicable, For Item Rate Contracts, no alteration will be allowed in the Schedule of Rates by reason of works or any part of them being modified, altered, extended, diminished or committed. The Schedule of Rates are fully inclusive of rates which have been fixed by the Contractor and agreed to by the Employer/Owner and cannot be altered.

Based on the mechanism of Tender as described in the Special Conditions of Contract (SCC), the methodologies described above shall prevail. However, payment for any additional work which is not covered in the Schedule of Rates, shall only be released on issuance of change order.

81. Procedure for Measurement and Billing

81.1 Billing Procedure

Following procedures shall be adopted for billing of works executed by the Contractor.

- 81.1.1 For EPC/ Lumpsum Turnkey Contracts, the billing procedure will follow as per the prescribed payment terms as defined in Special Conditions of Contract (SCC).
- 81.1.2 If applicable, For Item Rate Contracts, all measurements shall be recorded in sextuplicate on standard measurement sheets in duly approved formats for scrutiny and passing by Employer/ Owner. Employer/ Owner shall scrutinize and check the measurements recorded on the sheets and shall certify correctness of the same on the measurement sheets.
- 81.1.3 Engineer-in-Charge/Project Manager shall pass the bills after carrying out the comprehensive checks in accordance with the terms and conditions of the Contracts, within 21 (Twenty-one) days of submission of the bills along with all necessary enclosures and documents, complete in all respects and send the same to the Owner to effect payment to the Contractor as per the defined payment terms.
- 81.1.4 Owner shall make all endeavor to make payments of undisputed amount of the bills submitted based on the joint measurements within 30 (Thirty) days from the date of certification by the Engineer-in-Charge/Project Manager. Any disputed claims/amounts will be mutually settled and paid accordingly.
- 81.1.5 Measurements shall be recorded as per the methods of measurement spelt out in Contract Document.

81.2 Secured Advance on Material

Unless otherwise provided in the SCC of the tender, no 'Secured Advance' on security of materials brought to site for execution of contracted items(s) shall be paid to the Contractor whatsoever.

81.3 Dispute in Mode of Measurement

In case of any dispute as to the mode of measurement not covered by the Contract to be adopted for any item of Work, mode of measurement as per latest Indian Standard Specifications shall be followed.

81.4 Rounding-Off of Amounts

In calculating the amount of each item due to the Contractor in every certificate prepared for payment, sum of less than 50 paise shall be omitted and the total amount on each certificate shall be rounded off to the nearest rupees, i.e., sum of less than 50 paise shall be omitted and sums of 50 paise and more up to one rupee shall be reckoned as one rupee.

82. Lumpsum in Tender

- 82.1 The payment against any Lumpsum item shall be made only on completion of that item (Excluding Milestones linked payment structure) as per the provision of the Contract after certification by Engineer-in-Charge/Project Manager.

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83. Running Account Payments to be regarded as Advance

- 83.1 All running account payments shall be regarded as payment by way of advance against the final payment only and not as payments for Work actually done and completed and shall not preclude the requiring of bad, unsound and imperfect or unskilled work to be removed and taken away and reconstructed or re-erected or be considered as an admission of the due performance of the Contract, or any part thereof, in this respect, or of the occurring of any claim by the Contractor, nor shall it conclude, determine or affect in any way the powers of the Employer/ Owner under these conditions or any of them as to the final settlement and adjustment of the accounts or otherwise, or in any other way vary or affect the Contract.

The final bill shall be submitted by the Contractor within 01 (One) Month of the date of the final acceptance of the Work; otherwise, the Engineer-in-Charge/Project Manager's measurement and of total amount payable for the Work accordingly shall be final and binding on all parties

84. Notice of Claims for Additional Payments

- 84.1 Should the Contractor consider that he is entitled to any extra payment for any extra/ additional Works or Material change in original Specifications carried out by him in respect of Work he shall forthwith give notice in writing to the Engineer-in-Charge/Project Manager that he claims extra payment. Such notice shall be given to the Engineer-in-Charge/Project Manager upon which Contractor bases such claims and such notice shall contain full particulars of the nature of such claim with full details of amount claimed. Irrespective of any provision in the Contract to the contrary, the Contractor must intimate his intention to lodge claim on the Owner within 10 (Ten) days of the commencement of happening of the event and quantify the claim within 30 (Thirty) days, failing which the Contractor will lose his right to claim any compensation /reimbursement/ damages etc. or refer the matter to arbitration. Separate bills shall be raised for the extra claim.

- 84.2 Engineer-in-Charge/Project Manager shall review such claims within a reasonably period of time and cause to discharge these in a manner considered appropriate after due deliberations thereon. However, Contractor shall be obliged to carry on with the Work during the period in which his claims are under consideration by the Owner, irrespective of the outcome of such claims, where additional payments for Works considered extra are justifiable in accordance with the Contract provisions,

Owner shall arrange to release the same in the same manner as for normal Work payments. Such of the extra works so admitted by Owner shall be governed by all the terms, conditions, stipulations and specifications as are applicable for the Contract. Settlement of all extra claims shall be taken up after Project commissioning.

85 Payment of Contractor's Bill

- 85.1 Payment due to the Contractor shall be made by the Owner either by e-Banking or by Account Payee Cheque forwarding the same to registered office or the notified office of the Contractor. In no case, will Owner be responsible if the cheque is mislaid or misappropriated by unauthorized person/ persons. In all cases, the Contractor shall present his bill duly pre-receipted on proper revenue stamp & payment shall be made in Indian Currency only.
- 85.2 In general payment of final bill shall be made to Contractor within 60 days of the submission of bill on joint measurements, after completion of all the obligations under the Contract against the final completion.

86 Receipt for Payment

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- 86.1 Receipt for payment made on account of work when executed by a company, must be signed by a person holding due power of attorney in this respect on behalf of the Contractor, except when the Contractors are described in their tender as a limited company in which case the receipts must be signed in the name of the company by one of its principal officers or by some other person having authority to give effectual receipt for the company.

87. Handing Over – Taking Over

- 87.1 Subsequent to Operational Acceptance of the Facilities by the Employer and within 15 (Fifteen) days of the commencement of the O&M period, the Contractor shall furnish an Indemnity Bond/undertaking as per “Sample Forms and Formats” which is to be executed by the Contractor for the plant handed over by Owner for performance of its O&M Contract (Entire Solar Photo Voltaic Plant).

The Facility shall be taken over by the Owner upon successful Operational Acceptance in accordance with GCC Clause 43.3 (Operational Acceptance).

Immediately after taking over of complete facilities (s), the Facilities will be handed over to the Contractor for Comprehensive Operation & Maintenance for a period as mentioned in the Contract document.

88. Final Decision and Final Acceptance

- 88.1 Upon expiry of the period of liability & the Works have been duly maintained by the Contractor during monsoon or such period as hereinbefore provided in Clause 73 & 74 and that the Contractor has in all respect duly made-up any subsidence and performed all his obligations under the Contract, the Owner give a final acceptance to that effect and the Contractor shall not be considered to have fulfilled the whole of his obligations under Contract until Final acceptance shall have been given by the Owner notwithstanding any previous entry upon the Work and taking possession, working or using of the same or any part thereof by the Owner.

89. Certificate and Payments on Evidence of Completion

- 89.1 Except the Final Acceptance, no other payments on general account shall be taken to be an admission by the Owner of the due performance of the Contract or any part thereof or of occupancy or validity of any claim by the Contractor.

90. Deductions from the Contract Price

- 90.1 All costs, damages or expenses which Owner may have paid or incurred, which under the provisions of the Contract, the Contractor is liable/ will be liable, will be claimed by the Owner. All such claims shall be billed by the Owner to the Contractor regularly as and when they fall due. Such claims shall be paid by the Contractor within 15 (Fifteen) days of the receipt of the corresponding bills and if not paid by the Contractor within the said period, the Owner may, then, deduct the amount from any moneys due including Contract Performance Security or becoming due to the Contractor under the Contract or may be recovered by actions of law or otherwise, if the Contractor fails to satisfy the Owner of such claims.

[G] TAXES AND INSURANCE

91. Taxes & Duties – Goods & Service Tax

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- 91.1 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 Sub-contractor 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.
- 91.2 The Owner shall bear and pay/reimburse to the Contractor Goods and Services Tax (GST) applicable on: (a) Plant and Equipment (including Type Test Charges) and Mandatory Spares to be supplied from within the Employer's country to be incorporated in the Facilities, by the law of country where the site is located, (b) local transportation & insurance, other local costs incidental to delivery of plant & equipment including mandatory and (c) Installation Services including Erection, Civil & Allied Works and other services. However, all other taxes, duties & levies as may be applicable on goods and services specified in under the contract and on the materials used for civil construction works and erection & commissioning shall be to the contractor's account and no separate claim in this regard will be entertained by the Employer. Notwithstanding anything to contrary contained in the Contract, the Contractor's right to payment under the Contract is subject to issuance of valid tax invoice, payment of applicable GST to the credit of appropriate Government and submission of valid particulars of tax invoice under GST returns in accordance with GST Law. The Contractor shall issue tax invoices, file appropriate returns, and deposit the applicable GST to the account of appropriate government within the time limit prescribed under the GST Law. In the event of any default, Contractor shall be liable to pay any penalty/demand raised on Owner due to default by Contractor, and the same shall be recovered/Contractor shall make good the loss. The Contractor shall be responsible for the issuance of e-way bill and other compliances relating to e-way bill as per GST law. The Owner will deduct GST at source at the applicable rates in case transactions under the contract are liable to GST deduction at source as per the prevailing provisions of GST Law.
- 91.3 If any tax exemptions, reductions, allowances or privileges are available to the Contractor in the country where the Site is located, the Owner shall use its best endeavors to enable the Contractor to benefit from any such tax savings to the maximum allowable extent.
- 91.4 The Contractor agrees to and does hereby accept full and exclusive liability for the payment of any and GST/all Taxes. now in force or hereafter imposed, increased, modified, from time to time in respect of Works and materials and all contributions and taxes for unemployment compensation, insurance and old age pensions, PF, ESI etc or annuities now in force or hereafter imposed by any Central or State Government authorities which are imposed with respect to or covered by the wages, salaries or other compensations paid to the persons employed by the Contractor and the Contractor shall be responsible for the compliance of all Sub-Contractors, with all applicable Central, State, Municipal and local law and regulation and requirement of any Central, State or local Government agency or authority.

Contractor further agrees to defend, indemnify and hold Employer/ Owner harmless from any liability or penalty which may be imposed by the Central, State or Local authorities by reason or any violation by Contractor or Sub-Contractor of such laws, suits or proceedings that may be brought against the Employer/ Owner arising under, growing out of, or by reason of the work provided for by this Contract, by third parties, or by Central or State Government authority or any administrative sub-division thereof. Tax deductions will be made as per the rules and regulations in force in accordance with acts prevailing from time to time.

- 91.5 Bidder should quote all-inclusive prices including the liability of GST (in line with the given SOR Format) whether on the works contract as a whole or in respect of bought out components used by the Contractor in execution of the Contract. Owner/Employer shall not be responsible for any such liability of the Contractor in respect of this Contract.

92. Income Tax

As per Indian Income Tax Act & Rules, Owner is required to deduct Income Tax at source from all the payments to be made to Nonresident/ Foreign Contractor. For this purpose, the Contractor shall

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be required to either furnish (i) the certificate from Indian Tax Authority or (ii) Ruling from “the Authority for Advance Ruling (AAR)” determining the applicable rate of Income tax in India before release of first payment. The Contractor will be required to submit PAN details to the Project Manager before the submission of the first bill. If the Owner orders any spare at a later date a, all applicable additional taxes & duties, if any, not included in the original price shall be to the account of Owner. Notwithstanding anything to contrary contained in the agreement/Purchase Order, Contractor/Supplier’s right to payment under the contract/agreement/Purchase Order is subject to issuance of valid tax invoice, payment of applicable GST to the credit of appropriate Government and submission of a valid particulars of tax invoice under GST returns in accordance with GST Act. Unless expressly stated otherwise, a common mechanism for reconciliation of input credit mismatch, to be followed by both Owner and Contractor/Supplier, shall be mutually agreed so that both parties follow the same procedure for disclosing the transactions in their respective returns. Notwithstanding anything in the agreement/ contract, penalty / damages shall be recovered in case the Contractor/Supplier makes a default in following the agreed procedure. Contractor/Supplier shall issue tax invoices, file appropriate returns, and deposit the applicable GST to the account of appropriate government within the time limit prescribed under the GST Law. In the event of any default, Contractor/Supplier shall be liable to pay the amount which may be imposed on Owner due to such default. Contractor/Supplier should comply with the provisions of e-way bill notified by appropriate authorities from time to time. The existing provisions regarding road permit will continue till such time if applicable. Owner will deduct GST at source at the applicable rates in case transactions under the contract are liable to GST deduction at source as per the prevailing provisions of GST Law.

93. Statutory Variations

93.1 Goods & Service Tax (GST) [applicable for both Centre and state] and other levies [if any] payable by the Contractor under the Contract, or for any other cause, shall be included in the rates/ prices and the total bid-price submitted by the Bidder. Applicable rate of GST shall be indicated in Agreed SOR formats.

93.2 For the purpose of the Contract, it is agreed that the Price as specified in the Schedule of Rates (SOR) is based on the taxes, duties, levies and charges prevailing on seven (7) days prior to the deadline set for bid submission in the country where the Site is located. 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 therefrom, as the case may be, in accordance with the Change in Laws and Regulations clause hereof. However, these adjustments would be restricted to direct transactions between the Employer and Contractor and Bought out items (dispatched directly from sub vendor's works to Site). These adjustments shall not be applicable on procurement of raw materials, intermediary components and intermediary services etc. by the Contractor

All these adjustments would be carried out by considering the base price of GST/taxes equivalent to the amount mentioned under GST/taxes column of the SOR/ PS.

93.3 However, any increase in the rate of these taxes, duties and levies beyond the contractual completion period shall be to Contractor's account and any decrease shall be passed on to Owner.

94. Insurance

To the extent specified in 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.

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The identity of the insurers and the form of the policies shall be subject to the approval of the Owner, who should not unreasonably withhold such approval.

- 94.1 During the Contract period including O&M period, i.e., during Construction & O&M period, all insurance related expenses shall be borne by the Contractor. The goods supplied under the Contract shall be fully insured against the loss or damage incidental to manufacture or acquisition, transportation, storage and delivery in such a manner that Owner shall not incur any financial loss, as long as the plant continues to remain under the custody of the Contractor. During O&M period also (after the Construction period is over), the insurances shall be in the scope of the Contractor.
- 94.2 In case of any loss or damage or pilferage or theft or fire accident or combination of the said incidents etc. under the coverage of insurance, the Contractor shall lodge the claim as per rules of insurance. Any FIR required to be lodged to local Police Station shall be the responsibility of the Contractor.
- 94.3 The Contractor shall arrange to supply/ rectify/ recover the materials without waiting for settlement of the insurance claim and even if the claim is unsettled for timely completion of the project. The final financial settlement with the insurance company shall rest upon the Contractor.
- 94.4 In case of any delay of the project attributable to the Contractor, the Contractor himself in consultation with Owner/Employer shall take the extension of insurance. Any financial implications shall be borne by the Contractor.
- 94.5 The Contractor should arrange for providing insurance coverage to its workmen under Workmen's Compensation Act or similar Rules and Acts as applicable during execution of work for covering risk against any mishap to its workmen. The Contractor shall also undertake a Third-Party Insurance and shall at all times keep Owner indemnified against any Third-Party claims and shall arrange to settle them at the earliest. The Owner/ Employer will not be liable for any such loss or mishap.
- 94.6 All other insurance like – transit insurance (Marine/ Cargo/ others as applicable), Construction All Risk, Erection All Risk, workmen compensation, fire, third party liability, insurance against theft, Contractor's Equipments, machinery breakdown policy, business interruption insurance, Property damage Insurance & Environmental risk insurance as required during the Construction and O&M period of the Plant shall be in the contractor's scope & shall borne by the Contractor.
- 94.7 Owner shall be named as co – insured under all insurance policies taken out by the Contractor, except for the workmen compensation, third party liability and Owner's liability insurances. All insurers' 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.
- 94.8 All the insurance cover taken for the construction and O&M period shall be seamless in nature & preferably taken from the same insurance company.
- 94.9 The insurance is to be suitably taken for the activity/ act which is required to cover all the risks associated to the activity / act. The Contractor shall be responsible to take suitable insurance till the completion of the O&M contract and indemnify the Employer/Owner from all associated risks whatsoever.
- 94.10 The Contractor shall be responsible to take suitable insurance(s) and claim management during and till the completion of the O&M contract and indemnify the Owner from all associated risks whatsoever.

Various Types of Insurance to be taken by Contractor during Construction & O&M period:

94.11 Employees State Insurance (ESI) Act

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The Contractor agrees to and does hereby accept full and exclusive liability for the compliance with all obligations imposed by the Employee State Insurance Act 1948 and the Contractor further agrees to defend, indemnify and hold Employer/ Owner harmless for any liability or penalty which may be imposed by the Central, State or Local authority by reason of any asserted violation by Contractor or Sub-Contractor of the Employees' State Insurance Act, 1948, and also from all claims, suits or proceeding that may be brought against the Employer/ Owner arising under, growing out of or by reasons of the work provided for by this Contractor, by third parties or by Central or State Government authority or any political sub- division thereof.

The Contractor agrees to fill in with the Employee's State Insurance Corporation, the Declaration Forms, and all forms which may be required in respect of the Contractor's or Sub-Contractor's employees, who are employed in the Work provided for or those covered by ESI from time to time under the Agreement. The Contractor shall deduct and secure the agreement of the Sub-Contractor to deduct the Employee's contribution as per the first schedule of the Employee's State Insurance Act from wages and affix the Employees Contribution Card at wages payment intervals.

The Contractor shall remit and secure the agreement of Sub-Contractor to remit to the Employee's State Insurance Corporation Account, the Employee's contribution as required by the Act. The Contractor agrees to maintain all cards and Records as required under the Act in respect of employees and payments and the Contractor shall secure the agreement of the Sub-Contractor to maintain such records. Any expenses incurred for the contributions, making contributions or maintaining records shall be to the Contractor's or Sub-Contractor's account.

94.11 Workmen Compensation and Employer's/Owner's Liability Insurance

Insurance shall be effected for all the Contractor's employees engaged in the performance of this Contract. If any of the work is sublet, the Contractor shall require the Sub-Contractor to provide workman's Compensation and Owner's liability insurance for the latter's employees if such Employees are not covered under the Contractor's Insurance.

94.12 Accident or Injury to Workmen

The Employer/ Owner shall not be liable for or in respect of any damages or compensation payable at law in respect or in consequence of any accident or injury to any workman or other person in the Employment of the Contractor or any Sub-Contractor and the Contractor shall indemnify and keep indemnified the Employer/ Owner against all such damages and compensation (save and except and aforesaid) and against all claims, demands, proceeding, costs, charges and expenses, whatsoever in respect or in relation thereto.

94.13 Transit/Cargo Insurance

In respect of all items to be transported by the Contractor to the Site of Work and any consequential risks, the cost of transit insurance shall be borne by the Contractor and the quoted price shall be inclusive of this cost.

Covering loss or damage occurring, while in transit from the supplier's or manufacturer's works or stores until arrival at the Site, to the Facilities (including spare parts therefor) and to the construction equipment to be provided by the Contractor or its Subcontractors.

Amount	Deductible Limits	Parties Insured	From	To
110% of the Ex-works value of supply	Nil	Contractor & Owner	Ware House	Ware House + 60 Days

94.14 Comprehensive Automobile Insurance

This insurance shall be in such a form as to protect the Contractor against all claims for injuries, disability, disease and death to members of public including Employer's/ Owner's men and damage to the property of others arising from the use of motor vehicles during on or off the site operations, irrespective of the Employer ship of such vehicles.

94.15 Installation 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 Defect Liability Period while the Contractor is on the Site for the purpose of performing its obligations during the Defect Liability Period.

Amount	Deductible Limits	Parties Insured	From	To
110% of the Ex-works value of supply	Nil	Contractor, Sub contractor & Owner	Receipt at site	Upto Defect Liability period

94.16 Comprehensive General Liability Insurance

a) This insurance shall protect the Contractor against all claims arising from injuries, disabilities, disease or death of member of public or damage to property of others due to any act or omission on the part of the Contractor, his agents, his employees, his representatives and Sub-Contractor's or from riots, strikes and civil commotion.

b) Contractor shall take suitable Group Personal Accident Insurance Cover for taking care of injury, damage or any other risks in respect of his Engineers and other Supervisory staff who are not covered under Employees State Insurance Act.

c) The policy shall cover third party liability. The third party (liability shall cover the loss/ disablement of human life (person not belonging to the Contractor) and also cover the risk of damage to others materials/ equipment/ properties during construction, erection and commissioning at site & during O&M period.

The value of third-party liability for compensation for loss of human life or partial/ full disablement shall be of required statutory value but not less than INR 02 (Two) Lakhs per death, INR 1.5 (One and Half) Lakhs per full disablement and INR 1 (One) Lakh per partial disablement and shall nevertheless cover such compensation as may be awarded by Court by Law in India and cover for damage to others equipment/ property as approved by the Purchaser. However, third party risk shall be maximum to INR 10 (Ten) Lakhs for death.

d) The Contractor shall also arrange suitable insurance to cover damage, loss, accidents, risks etc., in respect of all his plant, equipment and machinery, erection tools & tackles and all other temporary attachments brought by him at site to execute the work.

e) The Contractor shall take out insurance policy in the joint name of Owner and Contractor from one or more nationalized insurance company from any branch office at Project site.

f) Any such insurance requirements as are hereby established as the minimum policies and coverages which Contractor must secure and keep in force must be complied with, Contractor shall at all times be free to obtain additional or increased coverages at Contractor's sole expenses.

94.17 The Contractor shall also arrange suitable insurance to cover following during the O&M Period:

- Machinery Breakdown:** Electrical & or machinery breakdown of any machinery or other equipment resulting in costly repairs or even replacement of the solar panel.
- Business Interruption:** Cover for period of operational downtime i.e., covering the cash flow of the solar business as a result of an insured peril, for example fire or storm damage, machinery breakdown or equipment failure.
- Property Damage:** The insurance should cover material damage due to external causes such as fire, theft, vandalism, sabotage, hail damage, snow load, lightning strike, overload, operational mistakes, clumsiness, negligence & theft.
- Employers Liability:** Provides cover against the risk of accident from usual workplace risks such as working at height & manual handling during construction & O&M period..
- Environmental Risk Insurance:** Environmental damage coverage indemnifies solar system owners of the risk of either environmental damage done by their development or pre-existing damage on the development site.

94.18 ANY OTHER INSURANCE REQUIRED UNDER LAW OR REGULATIONS OR BY OWNER:

Contractor shall also carry and maintain any and all other insurance(s) which he may be required under any law or regulation from time to time without any extra cost to Owner. He shall also carry and maintain any other insurance which may be required by the Owner.

Amount	Deductible Limits	Parties Insured	From	To
To be indicated by the Contractor	Nil	Contractor, Sub contractor & Owner	Receipt at site	Upto Defect Liability period

95 Damage to Property or to any Person or any Third Party

- Contractor shall be responsible for making good to any loss or any damage to structures and properties belonging to the Owner or being executed or procured or being procured by the Owner or of other agencies within in the premises of all the work of the Owner, if such loss or damage is due to fault and/ or the negligence or willful acts or omission of the Contractor, his employees, agents, representatives or Sub-Contractors.
- The Contractor shall take sufficient care in moving his plants, equipment and materials from one place to another so that they do not cause any damage to any person or to the property of the Employer/ Owner or any third party including overhead and underground cables and in the event of any damage resulting to the property of the Owner or of a third party during the movement of the aforesaid plant, equipment or materials the cost of such damages including eventual loss of production, operation or services in any plant or establishment as estimated by the Employer/ Owner or ascertained or demanded by the third party shall be borne by the Contractor. Third party liability risk shall be INR 1 (One) Lakh for single accident and limited to INR 10 (Ten) Lakhs.

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- 95.3 The Contractor shall indemnify and keep the Employer/ Owner harmless of all claims for damages to property other than Employer's/ Owner's property arising under or by reason of this agreement, if such claims result from the fault and/ or negligence or willful acts or omission of the Contractor, his employees, agents, representative of Sub-Contractor.

[H] LABOUR LAWS

96. Labour Laws & Indemnity Bond

- i) No labour below the age of 18 (Eighteen) Years shall be employed on the Work.
- ii) The Contractor shall at his expense comply with all labour laws and keep the Employer/ Owner indemnified in respect thereof.
- iii) The Contractor shall employ labour in sufficient numbers either directly or through Sub-Contractor's to maintain the required rate of progress and of quality to ensure workmanship of the degree specified in the Contract.
- iv) The Contractor shall indemnify the Employer/ Owner against any payments to be made under and for the observance of the provisions of the aforesaid labour compliances without prejudice to his right to obtain indemnity from his Sub-Contractor's.
- v) The Contractor shall also indemnify to keep the Owner/ Employer harmless from any act of omission or negligence on the part of the Labour Laws compliance in following the statutory requirements with regard to Labour laws. Against the signing of the contract, The Indemnity Bond shall be furnished by Contractor as per Format enclosed under Forms and Formats for the labour law compliance.
- vi) Upon completion of the construction activities/ O&M activities, the Contractor shall obtain no – objection certificate (NOC) from local/ statutory bodies in respect to the fulfillment of all compliance related to labour law and submit a copy to the Employer/Owner prior to the final settlement

97. Void

98. Contractor to Indemnify the Employer/ Owner

- 98.1 The Contractor shall indemnify the Employer/ Owner and every member, office and employee of the Employer/ Owner, also the Engineer-in-Charge/Project Manager and his staff against all actions, proceedings, claims, demands, costs and expenses whatsoever arising out of or in connection with the matters referred to in Clause 95 and elsewhere and all actions, proceedings, claims, demands, costs and expenses which may be made against the Employer/ Owner for or in respect of or arising out of any failure by the Contractor in the performance of his obligations under the Contract Document.

The Employer/ Owner shall not be liable for or in respect of or arising out of any failure by the Contractor in the performance of his obligations under the Contract Document. The Employer/ Owner shall not be liable for or in respect of any demand or compensation payable by law in respect or in consequence of any accident or injury to any workmen or other person. In the employment of the Contractor or his Sub-Contractor the Contractor shall indemnify and keep indemnified the

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Employer/ Owner against all such damages and compensations and against all claims, damages, proceedings, costs, charges and expenses whatsoever in respect thereof or in relation thereto.

98.2 Payment of Claims and Damages

Should the Employer/ Owner have to pay any money in respect of such claims or demands as aforesaid the amount so paid and the costs incurred by the Employer/ Owner shall be charged to and paid by the Contractor and the Contractor shall not be at liberty to dispute or question the right of the Employer/ Owner to make such payments notwithstanding the same, may have been made without the consent or authority or in law or otherwise to the contrary.

98.3 In every case in which by virtue of the provisions of Section 12, Sub-section (i) of workmen's compensation Act, 1923 or other applicable provision of Workmen Compensation Act or any other Act, the Employer/ Owner is obliged to pay compensation to a workman employed by the Contractor in execution of the Work, the Employer/ Owner will recover from the Contractor the amount of the compensation so paid, and without prejudice to the rights of Employer/ Owner under Section 12, Sub- section (2) of the said Act, Employer/ Owner shall be at liberty to recover such amount or any part thereof by deducting it from the Contract Performance Security or from any sum due to the Contractor whether under this Contract or otherwise. The Employer/ Owner shall not be bound to contest any claim made under Section 12, Sub-section (i) of the said act, except on the written request of the Contractor and upon his giving to the Employer/ Owner full security for all costs for which the Employer/ Owner might become liable in consequence of contesting such claim.

99. Health and Sanitary Arrangements for Workers

99.1 In respect of all labour directly or indirectly employed in the Works for the performance of the Contractor's part of this agreement, the Contractor shall comply with or cause to be complied with all the rules and regulations of the local sanitary and other authorities or as framed by the Owner from time to time for the protection of health and sanitary arrangements for all workers.

99.2 The Contractor shall provide in the labour colony all amenities such as electricity, water and other sanitary and health arrangements. The Contractor shall also provide necessary surface transportation to the place of work and back to the colony for their personnel accommodated in the labour colony.

[I] APPLICABLE LAWS & SETTLEMENT OF DISPUTES

100. Arbitration

Normally all disputes should be settled by negotiations between the Owner and the concerned parties.

In case any dispute / difference is not settled through negotiations, the respective parties can seek remedy through Arbitration only by invoking the same within 120 days of raising of dispute. No disputes shall be referred to civil courts other than through Arbitration.

The issues/ disputes which cannot be mutually resolved through negotiations within the time stipulated above, all such disputes shall be referred to arbitration by Sole Arbitrator.

Owner shall suggest a panel of three independent and distinguished persons to the Contractor/ Supplier (as the case may be) to select any one among them to act as the Sole Arbitrator. In the event of failure of the other parties to select the Sole Arbitrator within 30 (Thirty) Days from the

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receipt of the communication suggesting the panel of arbitrators, the right of selection of the sole arbitrator by the other party shall stand forfeited and Owner shall have discretion to proceed with the appointment of the Sole Arbitrator. The decision of Owner on the appointment of the sole arbitrator shall be final and binding on the parties. The award of sole arbitrator shall be final and binding on the parties and unless directed/ awarded otherwise by the sole arbitrator, the cost of arbitration proceedings shall be shared equally by the parties.

The Arbitration proceedings shall be in English language and venue shall be the State of the Owner as specified in the BDS/SCC. Subject to the above, the provisions of (Indian) Arbitration & Conciliation Act 1996 and the Rules framed there under shall be applicable. All matter relating to this contract are subject to the exclusive jurisdiction of the court situated in the state of the Owner as specified in the BDS/SCC.

Above mentioned Arbitration clause will be applicable for the Disputes where the amount of claim is less than or equal to INR 1Crore (Indian Rupees One Crore only). For the cases of disputes where the amount of claim is more than INR 1 Crore (Indian Rupees One Crore), such disputes will be settled through commercial Courts established under the Commercial Courts, Commercial Division and Commercial Appellate divisions of High Courts act, 2015. Before going to the commercial court for settlement, such disputes be first referred to conciliation for settlement and in case of failure in conciliation, disputes be referred to the commercial courts for adjudication. In cases of funded packages, the aforesaid changes shall be implemented after concurrence of the funding agency.

FOR THE SETTLEMENT OF DISPUTES BETWEEN GOVERNMENT DEPARTMENT AND ANOTHER AND ONE GOVERNMENT DEPARTMENT AND PUBLIC ENTERPRISE AND ONE PUBLIC ENTERPRISE AND ANOTHER THE ARBITRATION SHALL BE AS FOLLOWS:

In the event of any dispute or difference between the parties hereto, such dispute or difference shall be resolved amicably by mutual consultation or through the good offices of empowered agencies of the Government.

If such resolution is not possible, then, the unresolved dispute or difference shall be referred to arbitration of an arbitrator to be nominated by Secretary, Department of Legal Affairs ("Law Secretary") in terms of the Office Memorandum No.55/3/1/75-CF, dated the 19th December 1975 issued by the Cabinet Secretariat (Department of Cabinet Affairs), as modified from time to time.

The Arbitration Act 1940 (10 of 1940) shall not be applicable to the arbitration under this clause. The award of the Arbitrator shall be binding upon parties to the dispute. Provided, however, any party aggrieved by such award may make a further reference for setting aside or revision of the award to Law Secretary whose decision shall bind the parties finally and conclusively.

101. Jurisdiction

- 101.1 The Contract shall be governed by and constructed according to the laws in force in INDIA. The Contractor hereby submits to the jurisdiction of the Courts situated at **"State of the Owner of the Project as defined in the BDS/SCC"** for the purposes of disputes, actions and proceedings arising out of the Contract, the courts at **"State of the Owner of the Project"** only will have the jurisdiction to hear and decide such disputed, actions and proceedings.

[J] SAFETY CODES

102. General

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- 102.1 Contractor shall adhere to safe construction practice and guard against hazardous, and unsafe working conditions and shall comply with Safety rules as set forth herein.

Any hazardous material used during construction or used as part of the plant has to be taken back by the supplier for recycling or dumping purpose after its operating / working life, so that it may not affect the environment or any living being. Contractor have to comply with State Pollution Board regulation.

103. Safety Regulations

- 103.1 i) In respect of all labour, directly employed in the Work for the performance of Contractor's part of this agreement, the Contractor shall at his own expense arrange for all the safety provisions as per safety codes of C.P.W.D., Indian Standards Institution. The Electricity Act, The Mines Act and such other acts as applicable.

ii) The Contractor shall observe and abide by all fire and safety regulations of the Owner. Before starting construction, Contractor shall consult with Owner's safety Engineers or Engineer-in-Charge/Project Manager and must make good to the satisfaction of the Employer/ Owner any loss or damage due to fire to any portion of the work done or to be done under this agreement or to any of the Employer's/Owner's existing property.

104. First Aid and Industrial Injuries

- 104.1 i) Contractor shall maintain first aid facilities for its employees and those of its Sub-Contractor.

ii) Contractor shall make arrangements for Ambulance Service, on requirement basis and for the treatment of industrial injuries. Names of those providing these services shall be furnished to Employer/ Owner prior to start of construction and their telephone numbers shall be prominently posted in Contractor's Site Office.

ii) All critical industrial injuries shall be reported promptly to Employer/ Owner, and a copy of Contractor's report covering each personal injury requiring the attention of a physician shall be furnished to the Employer/ Owner.

105. General Rules

- 105.1 Site is a Nonsmoking zone area. Hence, smoking within the battery area is strictly prohibited.

106. Contractor's Barricades

- 106.1 i) Contractor shall erect and maintain barricades required in connection with his operation to guard or protect: -

- a) Excavations
- b) Hoisting Areas.
- c) Areas adjudged hazardous by Contractor's or Employer's/ Owner's inspectors.
- d) Employer's/ Owner's existing property subject to damage by Contractor's Operations.
- e) Rail Road unloading spots

ii) Contractor's employees and those of his Sub-Contractor's shall become acquainted with Employer's/ Owner's barricading practice and shall respect the provisions thereof.

iii) Barricades and hazardous areas adjacent to, but not located in normal routes of travel shall be marked by red flasher lanterns at nights.

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107. Working at Height

107.1 i) Scaffolding or staging more than 4 meters above the ground or floor, swing suspended from an overhead support or erected with stationary support shall have a guard rail properly attached, bolted, braced and otherwise retarded at least one meter high above the floor or platform of such scaffolding or staging and extending along the entire length of the outside and ends thereof with only such openings as may be necessary for the delivery of materials. Such scaffolding or staging shall be so fastened as to prevent it from swaying from the building or structure.

ii) Working platform, gangway and stairway should be so constructed that they should not sag unduly or unequally and if the height of platform of the gangway or the stairway is more than 4 meters above the ground level or floor level, they should be closely boarded, should have adequate width and should be suitably fastened as in ii) above.

iii) Every opening in the floor of a building or in a working platform shall be provided with suitable means to prevent the fall of persons or materials by providing suitable fencing of railing whose minimum heights shall be 1 meter.

iv) While working at the substation and for construction of transmission line Towers and their subsequent maintenance, experienced manpower should be deployed with appropriate protection Equipments, such as insulating gloves, fall arrestor etc.

108. Excavation and Trenching

108.1 All trenches 1.5 Meters or more in depth, shall at all times be supplied with at least one ladder for each 50 Meters length or fraction thereof. Ladder shall be extended from bottom of the trenches to at least 1 meter above the surface of the ground. The sides of the trenches which are 1.5 Meters in depth shall be stepped back to give suitable slope or securely held by timber bracing, so as to avoid the danger of sides to collapse. The excavated materials shall not be placed within 1.5 Meters of the edge of the trench or half of the trench width whichever is more. Cutting shall be done from top to bottom. Under no circumstances undermining or under-cutting shall be done.

109. Demolition/ General Safety

109.1 i) Before any demolition work is commenced and also during the progress of the demolition work

a) All roads and open areas adjacent to the work site shall either be closed or suitably protected.

b) No electric cable or apparatus which is liable to be a source of danger shall remain electrically charged.

c) All practical steps shall be taken to prevent danger to persons employed from risk of fire or explosion or flooding. No floor, roof or other part of the building shall be so overloaded with debris or materials as to render it unsafe.

ii) All necessary personal safety equipment as considered adequate should be kept available for the use of the persons employed on the Site and maintained in condition suitable for immediate use, and the Contractor shall take adequate steps to ensure proper use of equipment by those concerned.

a) Workers employed on mixing asphaltic materials, cement and lime mortars shall be provided with protective footwear and protective gloves.

b) Those engaged in white washing and mixing or stacking or cement bags or any material which are injurious to the eyes be provided with protective goggles.

c) Those engaged in welding and cutting works shall be provided with protective face & eye shield, hand gloves, etc.

d) Stone breakers shall be provided with protective goggles and protective clothing and seated at sufficiently safe intervals.

e) When workers are employed in sewers and manholes, which are in use, the CONTRACTOR shall ensure that the manhole covers are opened and are ventilated at least for an hour before the workers are allowed to get into the manholes, and the manholes so opened shall be cordoned off with suitable railing and provided with warning signals or board to prevent accident to the public.

f) The CONTRACTOR shall not employ men below the age of 18 years and women on the work of painting with products containing lead in any form. Wherever men above the age of 18 years are employed on the work of lead painting, the following precautions should be taken.

1) No paint containing lead or lead product shall be used except in the form of paste or readymade paint.

2) Suitable face masks should be supplied for use by the workers when paint is applied in the form of spray or a surface having lead paint dry rubbed and scrapped.

3) Overalls shall be supplied by the Contractor to the workmen and adequate facilities shall be provided to enable the working painters to wash them during and on cessation of work.

iii) When the work is done near any place where there is risk of drowning, all necessary safety equipment should be provided and kept ready for use and all necessary steps taken for prompt rescue of any person in danger and adequate provision should be made for prompt first aid treatment of all injuries likely to be sustained during the course of the work.

iv) Use of hoisting machines and tackles including their attachments, anchorage and supports shall conform to the following standards or conditions:

a) These shall be of good mechanical construction, sound materials and adequate strength and free from latent defect and shall be kept in good working order.

b) Every rope used in hoisting or lowering materials or as means of suspension shall be of durable quality and adequate strength and free from patent defects.

c) Every crane driver or hoisting appliance operator shall be properly qualified and no person under the age of 21 years should be in charge of any hoisting machine including any scaffolding, winch or give signals to the operator.

d) In case of every hoisting machine and of every chain ring hook, shackle, swivel, and pulley block used in hoisting or lowering or as means of suspension, the safe working load shall be ascertained by adequate means. Every hoisting machine and all gears referred to above shall be plainly marked with the safe working load of the conditions under which it is applicable and the same shall be clearly indicated. No part of any machine or any gear referred to above in this paragraph shall be loaded beyond safe working load except for the purpose of testing.

e) As regards Contractor's machines, the Contractor shall notify the safe working load of the machine to the Engineer-in-Charge/Project Manager whenever he brings any machinery to Site of Work and get it verified by the Engineer concerned.

v) Motors, gears, transmission lines, electric wiring and other dangerous parts of hoisting appliances should be provided with efficient safeguards. Hoisting appliances should be provided with such means as to reduce to minimum the accidental descent of the load, adequate precautions should be taken to reduce the minimum risk of any part or parts of a suspended load becoming accidentally displaced. When workers are employed on electrical installations which are already energized,

insulating mats, wearing apparel, such as gloves, sleeves, and boots as may be necessary should be provided. The workers shall not wear any rings, watches and carry keys or other materials which are good conductors of electricity.

vi) All scaffolds, ladders and other safety devices mentioned or described herein shall be maintained in safe conditions and no scaffolds, ladder or equipment shall be altered or removed while it is in use. Adequate washing facilities should be provided at or near places of work.

vii) These safety provisions should be brought to the notice of all concerned by displaying on a notice board at a prominent place at the work-spot. The person responsible for compliance of the safety code shall be named therein by the Contractor.

viii) To ensure effective enforcement of the rules and regulations relating to safety precautions, the arrangements made by the Contractor shall be open to inspection by the Engineer-in-Charge/Project Manager or safety Engineer of the Owner.

ix) Notwithstanding the above clauses there is nothing in these to exempt the Contractor for the operations of any other Act or rules in force in the Republic of India. The work throughout including any temporary works shall be carried out in such a manner as not to interfere in any way whatsoever with the traffic on any roads or footpath at the site or in the vicinity thereto or any existing works whether the property of the Administration or of a third party.

In addition to the above, the Contractor shall abide by the safety code provision as per C.P.W.D. Safety code and Indian Standard Safety Code from time to time.

110. Care in Handling Inflammable Gas

110.1 The Contractor has to ensure all precautionary measures and exercise utmost care in handling the inflammable gas cylinder/ inflammable liquids/ paints etc. as required under the law and/ or as advised by the fire Authorities of the Owner or Administration.

111. Temporary Combustible Structures

111.1 Temporary combustible structures will not be built near or around work site.

112. Precautions against Fire

112.1 The Contractor will have to provide portable Fire Extinguishers, Fire Buckets and drums at worksite as per specifications & standards. They will have to ensure all precautionary measures and exercise utmost care in handling the inflammable gas cylinders/ inflammable liquid/ paints etc. as advised by Engineer-in-Charge/Project Manager. Temporary combustible structure will not be built near or around the work-site.

113. Explosives

113.1 Explosives shall not be stored or used on the Work or on the Site by the Contractor without the permission of the Engineer-in-Charge/Project Manager in writing and then only in the manner and to the extent to which such permission is given. When explosives are required for the Work they will be stored in a special magazine to be provided at the cost of the Contractor in accordance with the Explosives Rules. The Contractor shall obtain the necessary license for the storage and the use of explosives and all operations in which or for which explosives are employed shall be at sole risk and responsibility of the Contractor and the Contractor shall indemnify the Employer/Owner against any loss or damage resulting directly or indirectly therefrom. Only licensed persons shall be engaged for handling and working with explosives.

114. Preservation of Place

- 114.1 The Contractor shall take requisite precautions and use his best endeavors to prevent any riotous or unlawful behavior by or amongst his worker and others employed or the works and for the preservation of peace and protection of the inhabitants and security of property in the neighborhood of the Work. In the event of the Owner requiring the maintenance of a Special Police Force at or in the vicinity of the site during the tenure of works, the expenses thereof shall be borne by the Contractor and if paid by the Owner shall be recoverable from the Contractor.

115. Outbreak of Infectious Diseases

- 115.1 The Contractor shall remove from his camp such labour and their facilities who refuse protective inoculation and vaccination when called upon to do. Should Cholera, Plague or other infectious diseases break out the Contractor shall burn the huts, beddings, clothes and other belongings or used by the infected parties and promptly erect new huts on healthy sites as failing which the work may be done by the Owner and the cost thereof recovered from the Contractor.

116. Use of Intoxicants

- 116.1 The unauthorized sale of spirits or other intoxicants, beverages upon the work in any of the buildings, encampments or tenements owned, occupied by or within the control of the Contractor or any of his employee is forbidden and the Contractor shall exercise his influence and authority to the utmost extent to secure strict compliance with this condition.

In addition to the above, the Contractor shall abide by the safety code provision as per C.P.W.D. safety code, Indian Standard Code & OHSAS 18001 framed from time to time.



SECTION - V

SPECIAL CONDITIONS OF CONTRACT (SCC)

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SPECIAL CONDITIONS OF CONTRACT (SCC)

The following Special Conditions of Contract (SCC) shall supplement the General Conditions of Contract (GCC). Wherever there is a conflict, the provisions herein shall prevail over those in the GCC. The corresponding Clause number(s) of the GCC is/ are indicated in parentheses.

SCC No.	GCC Clause Ref. No. (If Applicable)	Details/ Description/ Special Conditions
1.	Definitions (GCC clause 1)	<p>The Employer is:</p> <p>Solar Energy Corporation of India Limited, 6th Floor, Plate-B, NBCC Office Block Tower-2, East Kidwai Nagar, New Delhi-110023, India</p> <p>Kind Attn.: Executive Director (C & P) / Sr Manager (C & P) Telephone Nos.: - 0091-(0)11-71989256/ 71989290 Fax No.: - 0091-(0)11-71989243 E-mail: - contracts@seci.co.in</p> <p>The Owner is:</p> <p>V O Chidambaranar Port Trust Tuticorin - 628004, Tamilnadu Telephone Nos.: - 0091-(0)461-2352290 (50 Lines) Fax No.: - 0091-(0)461-2354274 E-mail: - info@vocport.gov.in</p>
2.		<p>The Engineer-in-Charge:</p> <p>"Shall be intimated to the successful bidder"</p>
3.		<p>The Time for Commissioning for 5 MW grid connected ground based Solar PV Power Plant with other associated equipment as per this tender document in total shall be 9 (Nine) Months from the Date of the Notification of Award NOA/LOA/LOI</p> <p>Further Contractor is also to provide Operation & Maintenance Contract of Solar Photo Voltaic Plant for a period of 10 (Ten) years from the date of Operational Acceptance of the Plant.</p>

S. No.	Stage	Reference from D
3.1	Issue of NOA/ LOA/ LOI (as applicable)	Zero Date (D)
3.2	Commissioning of the Plant as stated under this Tender Document.	<u>D + 9 Months</u>

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SCC No.	GCC Clause Ref. No. (If Applicable)	Details/ Description/ Special Conditions
4	Location of Site (GCC clause 2.1.a)	<p>Add following to the existing clause regarding the Site Visit:</p> <ol style="list-style-type: none"> The proposed solar powered plant is to be up at V O Chidambaranar Port Trust, Tuticorin, Tamilnadu. The Tenderers are strongly advised to inspect and examine the location where the 5MW solar power plant is to be installed and their surroundings (sea shore area), at his own cost, and satisfy themselves before submitting their tenders. In general, they shall themselves obtain all necessary information as to risks, contingencies and other circumstances which may influence or affect their bid. A Bidder shall be deemed to have full knowledge of the site, whether he inspects it or not and no extra charges arising out of any misunderstanding or otherwise shall be allowed. Bidders shall submit a realistic offer for the execution of the work at their own cost without any liability on VOCPT. Submission of a bid by a bidder implies that he has read the Tender document and has made himself aware of the terms & conditions and scope and specifications of the work to be done and local conditions and other factors having a bearing on the execution of work. In connection with the site visit, the bidder shall submit an Undertaking along with the bid.
5	Construction Water Supply (GCC clause 2.3)	<p>Add following to the existing clause:</p> <p>The Contractor shall make own arrangements from the nearest supply source as per Owner terms and conditions, If Owner providing the water supply for construction & O&M activity.</p>
6	Construction Power Supply (GCC clause 2.4)	<p>Add following to the existing clause:</p> <p>The Contractor shall make own arrangements from the nearest supply source as per Owner terms and conditions, If Owner providing the Power supply for construction activity</p>
7	Land for Contractor's Field Office, Godown and Workshop (GCC clause 2.5)	<p>Add following to the existing clause:</p> <p>The Employer/ Owner will, at his own discretion and convenience and for the duration of the execution of the work make available near the site on chargeable basis as per port terms and conditions for construction of Contractor's Temporary Field Office, godowns, workshops and assembly yard required for the execution of the Contract.</p>

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8	Land for Residential Accommodation (GCC clause 2.6)	<p><u>Add following to the existing clause:</u></p> <p>Land shall be made available for residential accommodation for staff and labour of Contractor on chargeable basis as per VOC Port Terms and conditions, if available.</p>
9	Force Majeure (GCC clause 19)	<p><u>Add additional clause 19.9 to the existing clause:</u></p> <p>19.9 The contractor shall apply to consider any incidents under force majeure clause with justification and document proof and Owner/any certifying body will certify the incident under force majeure.</p>
10.	Liquidated Damages (GCC clause 20)	<p><u>Replace the existing clause by following:</u></p> <p>20.1 Subject to Force Majeure Clause, if the Contractor fails to comply with the Time for Completion /successful commissioning of Plant facilities in accordance with SCC Clause then the Contractor shall pay to the Owner a sum equivalent to one percent (1%) per week of the Contract Price for the whole of the facilities as liquidated damages for such default and not as a penalty, without prejudice to the Owner's other remedies under the Contract subject to the maximum limit of ten percent (10%) of Contract Price for the whole of the facilities. The Owner may, without prejudice to any other method of recovery, deduct the amount of such damages from any amount due or to become due to the Contractor. The payment or deduction of such damages shall not relieve the Contractor from his obligation to complete the Works, or from any other of his obligations and liabilities under the Contract. Once the maximum limit is reached, Owner may consider the termination of contract and/or shall have the discretion of getting executed the work from the Contractor with the maximum limit of Liquidated damages. Any such recovery on account of the Liquidated damages can be done from the running bills of the Contractor by Owner.</p> <p><u>Add following to the existing clause:</u></p> <p>20.4 The Time for Completion for whole of the facilities means the timelines provided for commissioning in line with the SCC clause No 3 above.</p> <p>20.5 No bonus will be given for earlier Commissioning of the Facilities or part thereof.</p>
		<p><u>Replace the existing clause by following:</u></p> <p>Against EPC/ LSTK & O&M Contract of the project, within 30 (Thirty) days from the issuance of the Notification of Award/ Letter of Intent/Letter of Award, the successful bidder shall furnish unconditional and irrevocable individual Bank Guarantees issued by any Nationalized Banks in the manner as mentioned below.</p> <p>The Contract Performance Security shall be in the form of Bank Guarantee only and shall be in the currency of the Contract and will</p>

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11.	Contract Performance Security (GCC clause 24)	<p>be issued in the name of the Owner as “V O Chidambaranar Port Trust, Tuticorin, Tamilnadu, India”</p> <p>The Contract Performance Security against this Contract need to be furnished as mentioned below:</p> <ol style="list-style-type: none"> 1. The value of the Contract Performance Security shall be 4% (Four percent) of the Contract Value (i.e., total sum of the Supply & Service Contract). This Performance security will be valid for a total period of 132 Months (09 Months Project commissioning period) + 120 Months O & M Period + 03 Months additional) from the date of its issuance. The successful bidder can submit Contract Performance Security with initial validity of one year and the same may be extended every year till completion of the total 132 months period. 2. Further, 5% (Five percent) of each running bill will be deducted as security deposit till the security deposit value becomes 5% of the contract value. This Security deposit will be released to the contractor against the Operational Acceptance of the plant Facility pursuant to successful Guarantee Tests and demonstration of Performance Ratio (PR) including submission of all as-built drawings and O&M manual. 3. The Contract Performance Security shall be towards faithful performance of the contractual obligations and performance of equipment. 4. In case of any default or failure of the Contractor to comply with the requirements of any of the Obligations covered under this Tender Document and/ or Contract Agreement shall constitute sufficient grounds for forfeiture of the entire Contract Performance Security, in such cases, the liability on account of GST will be borne by the contractor. 5. Further, any delay beyond 30 (Thirty) days shall attract delay charges @ 1.25% per month on the total Contract Performance Security amount, calculated on pro-rata basis accordingly. However, total project completion period shall remain same. Part Security shall not be accepted. Further, Owner at its sole discretion may cancel the Contract Agreement/ NOA & forfeit 100% of EMD inclusive of GST, in case Contract Performance Security is not submitted within 45 (Forty-Five) days from issuance of NOA/LOA/LOI. <p>Contract Performance Security submitted shall be released to the Contractor without any interest not later than 75 (Seventy-Five) days after the successful completion of the complete O&M period (10 Years) subject to the approval and acceptance of the O&M period deliverables.</p>
12.	Contractor's responsibility (GCC clause 32.1.3)	<p><u>Replace the existing clause 32.1.3 by following:</u></p>

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		<p>In the matter of connectivity of plant to DISCOM's substation including bay allocation, etc, the contractor shall acquire all necessary approvals/permissions on behalf of owner. The statutory fees pertaining to such shall be reimbursed by the owner on production of documentary evidence. In this regard, any document required from Owner/ Employer shall be intimated at least 10 days prior to submission. Contractor has to ensure safe keeping of the documents and diligent use. It is the responsibility of the Contractor to safe keep and return all the original approvals, permits, licenses, certificates and other relevant document generated as a result of the setting up/operating the power plant.</p>
13.	<p>Functional Guarantees (GCC clause 43.1.1)</p>	<p><u>Add following to the existing clause:</u></p> <p>1. During the Operational Acceptance after providing 03 chances for the PR demonstration, any shortfall in the Performance Ratio (PR) as determined through the PR Test Procedure specified in Section VII, Scope of Work and Technical Specifications, & "PERFORMANCE GUARANTEE TEST PROCEDURE", will attract imposition of penalty. For every 1% shortfall in PR below the committed PR value, a penalty of 1% of the total Contract Value (i.e., total sum of all the Supply, Service and absolute value of O & M Contract) shall be levied. In case the Contract Performance Security has already been encashed on account of any default/delays, the penalty amount will be recovered from any due payments to the contractor. In case the Plant PR Shortfall is more than 5% than the specified PR value, then the total plant will be accepted on as-is basis & the total Contract Performance Security submitted by the contractor will be forfeited & payments linked to operational acceptance will not be made.</p> <p>2. If any shortfall from specified yearly CUF shall attract the LD @ INR 4.07/kWh, will be imposed as compensation for the loss of generation for each unit shortfall. The CUF shall be calculated as per the formula mentioned Section VII, Scope of Work and Technical Specifications.</p> <p>3. In case the Project fails to generate any power continuously for 1 month any time during the O&M period, apart from the force majeure and grid outages as certified by competent authority, it shall be considered as "an event of Contractor's default". In the case of default, the entire Contract Performance Security will be forfeited & the Owner may terminate the O&M contract.</p> <p>4. Liquidated damages during O&M period against breakdown of other Infrastructure of Plant which doesn't affect the generation of power, directly such as but not limited to civil infrastructure, water supply system/network, other Infrastructure developed by the Contractor as a Scope of Work for the Project (Section-VII: Scope of Works & Technical Specifications) shall be penalized @ Rs.1000/day, per incident of breakdown reported beyond 07 Days of such reporting. Cumulative value of such penalty shall be limited to 50% of yearly O&M cost.</p>

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		<p>5. The Liquidated Damages as specified on account of delays and on account of deviations in Functional Guarantees as above shall be assessed and levied independent of each other.</p> <p>6. The deviation charges, as per applicable regulations, for the difference in units between scheduled and actual generation shall be recovered from the contractor on following basis.</p> <p>a) In case of any deviation due to forecasting and scheduling error , Contractor shall bear the cost/Penalty.</p> <p>b) In case of localized thunderstorm/sand storm, SECI shall bear the deviation charges till the time period before which the revision of scheduling is not allowed, as per applicable regulation.</p> <p>c) In case if there is a component/Machine/Inverter failure. SECI shall bear the deviation charges on account of such failure till the time period block before which the revision of scheduling is not allowed, affected as per applicable regulation. The contractor shall bear the deviation charges due to such failure beyond such time period.</p>
14.	<p>Conditions for Issue of Materials</p> <p>(GCC clause 60)</p>	No material will be issued to the contractor by the owner, SECI for this Project.
15.	<p>Training</p> <p>(GCC clause 76.6)</p>	The contractor shall provide training (free of cost) to the personnel of SECI/Nominated person of SECI for 50 (Fifty) man-days at his works/or at the mutually agreed designated place/ or at site for erection, testing, commissioning and O&M of the Project. Expenses towards travel, lodging, and boarding for the personnel shall be borne by SECI. Such training may include Class Room & hands on experience etc as mutually agreed.
16.	<p>Schedule of Rates & Payments</p> <p>(GCC clause 80.1)</p>	<p><u>Add following to the existing clause:</u></p> <p>All payment shall be made against invoices raised in line with the approved billing break up under individual heads of Supply, Services and Civil works. Following general payment terms will be followed which will be payable after complying the provision of ALMM clause only</p> <p>A. The payment for the Supply Portion of the First Contract (Supply & Service Contract) shall be made as per the following terms and conditions:</p> <p>i) Interest bearing initial advance (OPTIONAL) of 10% of the Contract Value (i.e., total sum of the Supply Contract) shall be released to the contractor upon receipt of unconditional acceptance of NOA, detailed Performa invoice of contractor and against submission of unconditional & irrevocable Advance Bank Guarantee (ABG) with a validity period up to date of final commissioning total amounting to 110% of total advance amount. The ABG needs to be submitted in</p>

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		<p>addition to the Contract Performance Security. The annual interest rate shall be calculated based SBI one-year MCLR as applicable.</p> <p>ii) Sixty percent (60%) payments shall be paid on Pro rata basis against supply, receipt and acceptance of Materials at site on submission of documents (except Advance Bank Guarantee) indicated under clause i) above, Contractor's detailed invoice & packing list identifying contents of each shipment, evidence of dispatch (GR/ LR copy), Manufacturer's/ Contractor's Guarantee certificate of Quality, submission of the certificate by the Executing Agency's authorized representative that the item(s) have been received and MDCC (Material Dispatch Clearance Certificate) issued by Employer's authorized representative in original.</p> <p>* In case the Interest-bearing initial advance (OPTIONAL) of 10% of the Contract Value is availed by the contractor, then this 10% advance payment amount will be adjusted (deducted) in the amount payable at point No A ii) above. Further, in case the Interest-bearing initial advance (OPTIONAL) of 10% of the Contract Value is not availed by the contractor, then this 10% payment amount will be payable along with the point No A ii) along with the 60% payment milestone.</p> <p>Also, up-to-date accrued interest shall also be recovered.</p> <p>(iii) Thirty percent (30%) payments shall be paid against successful erection, testing and commissioning of materials on pro rata basis at site.3</p> <p>(iv) Final Ten percent (10%) payment of Supplies shall be paid against submission of the BG of the equivalent amount & against the Operational Acceptance of the plant Facility pursuant to successful Guarantee Tests and demonstration of Performance Ratio (PR) including submission of all as-built drawings and O&M manual. This BG shall be valid for a period of 18 (Eighteen) months from the date of its issuance & will be released after CUF demonstration on completion of first year of O&M, pursuant to the submission of all requisite documentation up to the final acceptance of the Plant facilities. However, in case of any delay, the BG shall be extended suitably.</p> <p>B. The payment for the Service Portion of the First Contract (Supply & Service Contract) shall be made as per the following terms and conditions. No Initial Advance Payment shall be made against the Service Portion Part.</p> <p>i) For Freight and Insurance Portion, the payment shall be made in line with Supply Portion of the First Contract, as described in point A (ii) of this clause, without releasing any initial advance. The complete payment of the freight will be done along with the respective deliveries of the supply portion at site.</p> <p>ii) For Erection, Testing and Commissioning Portion, the payment shall be made as detailed below: -</p>
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		<p>(a) Eighty Percent (80%) of the total price of Design, Engineering, Erection, Testing and Commissioning shall be paid on pro-rata basis on completion of installation of equipment on certification by the Engineer-In-Charge/ Project Manager for the quantum of work completed after successful clearance of quality check points involved in the quantum of work billed.</p> <p>(b) Ten Percent (10%) of the total price of Design, Engineering, Erection, Testing and Commissioning shall be paid against successful commissioning of the plant on pro rata basis for the capacity commissioned.</p> <p>(c) Final Ten percent (10%) payment of Design, Engineering, Erection, Testing and Commissioning shall be paid against submission of the BG of the equivalent amount & against the Operational Acceptance of the plant Facility pursuant to successful Guarantee Tests and demonstration of Performance Ratio (PR) including submission of all as-built drawings and O&M manual. This BG shall be valid for a period of 18 (Eighteen) months from the date of its issuance & will be released after CUF demonstration on completion of first year of O&M, pursuant to the submission of all requisite documentation up to the final acceptance of the Plant facilities. However, in case of any delay, the BG shall be extended suitably.</p> <p>iii) For Civil & Allied works portion, of the 1st contract, the payment shall be made as detailed below:</p> <p>(a) Eighty Percent (80%) of the total price of Civil Works shall be paid progressively on certification by the Project Manager/ Engineer In - Charge for the quantum of work completed/ Milestones achieved after successful clearance of quality check points involved in the quantum of work.</p> <p>(b) Ten Percent (10%) of the total price of Civil Works shall be paid against successful commissioning of the plant on pro rata basis for the capacity commissioned.</p> <p>(c) Final Ten percent (10%) payment of Civil Works shall be paid against submission of the BG of the equivalent amount & against the Operational Acceptance of the plant Facility pursuant to successful Guarantee Tests and demonstration of Performance Ratio (PR) including submission of all as-built drawings and O&M manual. This BG shall be valid for a period of 18 (Eighteen) months from the date of its issuance & will be released after CUF demonstration on completion of first year of O&M, pursuant to the submission of all requisite documentation up to the final acceptance of the Plant facilities. However, in case of any delay, the BG shall be extended suitably.</p> <p>C. For the Second Contract (related to Operation & Maintenance Part), the payment shall be made as detailed below: -</p>
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		<p>(a) Operation and Maintenance of the entire Project payment will be released on quarterly basis at the end of every quarter for each year till 10 (Tenth) years.</p> <p>(i) Year 1: OM -1 (ii) Year 2: OM -2 (iii) Year 3: OM -3 (iv) Year 4: OM -4 (v) Year 5: OM -5 (vi) Year 6: OM -6 (vii) Year 7: OM -7 (viii) Year 8: OM -8 (ix) Year 9: OM -9 (x) Year 10: OM -10</p> <p>In case of any default, Non-Performance or breach of contractual conditions of the O&M contract during the O&M period, the penalties/deductions, if applicable will be liable to be deducted from the Quarterly O&M payments first & then from the Contract Performance Security.</p> <p>E. All the payment shall be released from Owner's Head Office, Tamilnadu upon submission of Original Documents like MDCC, delivery challan, warranty certificate, LR, WCC, MRN, commissioning certificate, handing over certificate, Insurance, PF, ESI, etc as required and mentioned against each Milestone payment, duly certified by the authorized representative of the Employer/Owner.</p>
17.	<p>Taxes & Duties - Goods & Service Tax (GCC clause 91)</p>	<p><u>Add the following to the existing clause:</u></p> <p>Exemption of GST or any other taxes and duties (if applicable) on Items Manufactured for Grid Connected Solar Photo Voltaic Power Generation Projects</p> <p>As per extant guidelines of Department of Revenue, Ministry of Finance, Govt. of India, the benefits of exemption of GST or any other taxes and duties (if applicable on items manufactured for grid connected Solar Photo Voltaic Power Generation Projects) may be available for the items to be supplied under the contract, Bidder may appraise itself of the relevant policies and quote accordingly. The Employer shall issue the requisite certificate (if required) 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. The Bidder shall be solely responsible for obtaining the benefits of exemption on excise duty GST or any other taxes and duties (if applicable) on the items to be supplied under the contract from the Govt. of India. In case of failure of the bidder to receive the benefits partly or fully from Govt. of India or in case of delay in receipt of such benefits, the</p>

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		Employer shall neither be responsible nor liable in this regard in any manner whatsoever.
18.	Contractor's responsibility (GCC clause 96)	<p><u>Add following to the existing clause:</u></p> <p>The clause shall describe suitably that Port will not provide any supportive documents for obtaining Labour license. The contractor shall obtain labour license in their organization name.</p>
19.	Arbitration (GCC clause 100)	<p><u>Replace the existing clause by following:</u></p> <p>a. <u>CONCILIATION AND SETTLEMENT OF DISPUTES:</u></p> <p>Regarding any constructed dispute to be referred to the Conciliation and Settlement Committee for resolution, the procedure for reconciliation and settlement shall be followed as per the guidelines issued by the Ministry of Shipping, Ports, and Waterways. (Ref. CONCILIATION AND SETTLEMENT GUIDELINES dt 05.10.2021)</p> <p>b. <u>ARBITRATION:</u></p> <p>VOID</p>
20.	Jurisdiction (GCC clause 101)	<p><u>Replace the existing clause by following:</u></p> <p>The contract shall be governed by and constructed according to the laws in force in India. The Contractor shall hereby submit to the jurisdiction of the courts situated at Tuticorin for the purpose of actions and proceedings arising out of this contract, and the courts at Tuticorin shall have the sole jurisdiction to hear and decide such actions and proceedings.</p>



SECTION - VI

SAMPLE FORMS & FORMATS

5 MW (AC) SPV Project

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Signature of
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Preamble

This Section (Section - VI) of the Bidding Documents [named as Sample Forms and Procedures (FP)] provides proforma to be used by the bidders at the time of their bid preparation and by the Contractor subsequent to the award of Contract.

The Bidder shall complete, sign and submit with its bid the relevant FORMS to be used unamended, in accordance with the requirements included in the Bidding Documents.

The Bidder shall provide the EMD, if applicable in the form included hereafter acceptable to the Employer, pursuant to the provisions in the instructions to Bidders.

The Performance Security (ies) and Bank Guarantee for Advance Payment forms should not be completed by the bidders at the time of their bid preparation. Only the successful Bidder will be required to provide the Performance Security(ies) and Bank Guarantee for Advance Payment, according to one of the forms indicated herein acceptable to the Employer and pursuant to the provisions of the General and Special Conditions of Contract, respectively.

Depending on specific facts and circumstances related to the Bid/ Tender and the contract, the text of the Forms herein may need to be modified to some extent. The Employer reserves the right to make such modifications in conformity with such specific facts and circumstances and rectify and consequent discrepancies, if any. However, modifications, if any, to the text of the Forms that may be required in the opinion of the Bidder/ Contractor shall be effected only if the same is approved by the Employer. The Employer's decision in this regard shall be final and binding.

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LIST OF FORMS & FORMAT

Form No.	Description
F-0	COVERING LETTER
F-1	BIDDER'S GENERAL INFORMATION
F-2	FORMAT FOR INDEMNITY BOND TO BE EXECUTED BY THE CONTRACTOR FOR THE REMOVAL / DISPOSAL OF SCRAP/DISPOSAL OF SURPLUS MATERIAL – IF APPLICABLE
F-3	INDEMNITY BOND TO BE EXECUTED BY THE CONTRACTOR FOR THE PLANT HANDED OVER FOR PERFORMANCE OF ITS O&M CONTRACT (ENTIRE SOLAR PHOTO VOLTAIC PLANT) – DURING HANDOVER
F-4A	PROFORMA OF "BANK GUARANTEE" FOR "EARNEST MONEY DEPOSIT (EMD)"
F-5	INDEMNITY BOND
F-6	NO DEVIATION CONFIRMATION
F-7	DECLARATION REGARDING BANNING AND LIQUIDATION, COURT RECEIVERSHIP ETC.
F-8	DECLARATION ON RESTRICTION ON PROCUREMENT FROM CERTAIN COUNTRIES: MoF OM No 6/18/2019-PPD dated 23.07.2020
F-9	PROFORMA OF "BANK GUARANTEE" FOR "CONTRACT PERFORMANCE SECURITY"
F-11	UNDERTAKING FOR INDEMNIFYING THE EMPLOYER AGAINST ANY ENCUMBRANCE ON THE PROJECT LAND TRANSFERRED TO EMPLOYER IN RESPECT OF DEVELOPMENT OF THE SOLAR PV PROJECT
F-12	DECLARATION REGARDING THE PROCUREMENT OF SOLAR INVERTERS & SOLAR MODULES FROM CLASS I LOCAL SUPPLIERS
F-13	BIDDER'S EXPERIENCE
F-14	DISCLOSURE FOR ALMM COMPLIANCE
F-16	FORMAT OF CHARTERED ACCOUNTANT CERTIFICATE FOR FINANCIAL CAPABILITY OF THE BIDDER
F-17	FORMAT FOR JOINT VENTURE AGREEMENT
F-17A	FORMAT FOR POWER OF ATTORNEY FOR JOINT VENTURE AGREEMENT
F-18	FORMAT FOR CONSORTIUM AGREEMENT

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F-18A	FORMAT FOR POWER OF ATTORNEY FOR CONSORTIUM AGREEMENT
F-19	E-BANKING FORMAT
F-20	PROFORMA OF "BANK GUARANTEE" FOR "ADVANCE PAYMENT"
F-22	LIST OF BANKS
F-23	SHAREHOLDING CERTIFICATE
F-24	POWER OF ATTORNEY FOR BIDDING COMPANY
F-25	FORMAT FOR CYBER SECURITY AGREEMENT
F-26	UNDERTAKING REGARDING SITE CONDITION

Form F-0

COVERING LETTER

(The Covering Letter should be submitted on the Letter Head of the Bidding Company)

Ref.No. _____

Date: _____

From: _____ (Insert name and address of Bidding Company)

Tel.#: _____

Fax#: _____

E-mail address# _____

To

Solar Energy Corporation of India Limited

(A Government of India Enterprise)

6th Floor, Plate-B, NBCC Office Block Tower-2, East Kidwai Nagar, New Delhi-110023, India

Sub: Bid for "Tender for Design, Engineering, Supply, Construction, Erection, Testing & Commissioning of 5 MW (AC) grid connected ground based Solar PV Power Plant including 10 years plant O&M at V. O. Chidambaranar Port Trust, Tuticorin, Tamilnadu, India"

Dear Sir / Madam,

1. We, the undersigned.... [insert name of the 'Bidder'] having read, examined and understood in detail the tender Document for "Tender for Design, Engineering, Supply, Construction, Erection, Testing & Commissioning of 5 MW (AC) grid connected ground based Solar PV Power Plant including 10 years plant O&M at V. O. Chidambaranar Port Trust, Tuticorin, Tamilnadu, India" hereby submit our Bid comprising of Techno Commercial Bid and Price Bid.

"We confirm that neither we nor any of our Parent Company/ Affiliate / Ultimate Parent Company has submitted Bid other than this Bid directly or indirectly in response to the aforesaid tender."

Note: In case a common Company/Companies directly or indirectly hold(s) more than 10% but less than 26% shareholding in more than one Bidder participating in the Tender, each of such Bidders will be required to submit the Disclosure as per the attached format. In such a case, the above-mentioned highlighted declaration/statement will be modified suitably by the bidder. In all other cases, this disclosure is not required & standard covering letter & other forms & formats will be applicable.

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Signature of
Bidder

2. We give our unconditional acceptance to the tender, dated..... and tender documents attached thereto, issued by Solar Energy Corporation of India Limited, as amended. As a token of our acceptance to the tender documents, the same have been initialled by us and enclosed to the Bid. We shall ensure that we execute such tender documents as per the provisions of the tender and provisions of such tender documents shall be binding on us.

3. Bid Capacity

We have bid for the capacity of 5 MW (AC) Solar PV Project along with Land.

4. Bid Processing Fees

We have enclosed a Bid Processing Fees of INR..... (*Insert Amount*), in the form of Demand Draft/ Banker's Cheque no..... (*Insert reference of the DD/ Banker's Cheque*) dated..... (*Insert date of DD/ banker's cheque*) from (*Insert name of Bank providing DD/ banker's cheque*) and valid up to and including in terms of Clause of this tender.

5. Earnest Money Deposit

We have enclosed an Earnest Money Deposit of INR..... (*Insert Amount*), in the form of bank guarantee no..... (*Insert reference of the bank guarantee*) dated..... (*Insert date of bank guarantee*) as per Format F-4 from (*Insert name of Bank providing BG*) and valid up to and including in terms of Clause of this tender. The offered quantum of power by us is ____ MWp. (*Insert total capacity offered*).

6. We have submitted our Price Bid strictly as per this tender, without any deviations, conditions and without mentioning any assumptions or notes for the Price Bid in the said format(s).
7. In case we are a Successful Bidder, we shall furnish a declaration at the time of commissioning of the Project to the effect that neither we have availed nor we shall avail in future any Incentive other than received from SECI for implementation of the project.

8. Acceptance

We hereby unconditionally and irrevocably agree and accept that the decision made by Solar Energy Corporation of India Limited in respect of any matter regarding or arising out of the tender shall be binding on us. We hereby expressly waive any and all claims in respect of Bid process.

We confirm that there are no litigations or disputes against us, which materially affect our ability to fulfil our obligations with regard to execution of projects of capacity offered by us.

9. Familiarity with Relevant Indian Laws & Regulations

We confirm that we have studied the provisions of the relevant Indian laws and regulations as required to enable us to submit this Bid and execute the tender documents, in the event of our selection as Successful Bidder. We further undertake and agree that all such factors as mentioned in tender have been fully examined and considered while submitting the Bid.

10. Contact Person

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Details of the contact person are furnished as under:

Name :
Designation :
Company :
Address :
Phone Nos. :
Fax Nos. :
E-mail address :

11. We are enclosing herewith the Envelope-I (Covering Letter, Processing Fees, EMD (If applicable), Bid Securing Declaration etc through Offline and Online, Techno-Commercial documents through online as per clause no. 11.1 of Section - II, ITB) and Envelope II (Price Bids) (through online) containing duly signed formats, each one duly sealed separately, in one original as desired by you in the tender for your consideration as per clause no. 11.0 of Section - II, ITB.

It is confirmed that our Bid is consistent with all the requirements of submission as stated in the tender and subsequent communications from Solar Energy Corporation of India Limited. The information submitted in our Bid is complete, strictly as per the requirements stipulated in the tender and is correct to the best of our knowledge and understanding. We would be solely responsible for any errors or omissions in our Bid. We confirm that all the terms and conditions of our Bid are valid for acceptance for a period as specified in BDS from the date of opening of "Techno-Commercial/ Un-priced Bid". We confirm that we have not taken any deviation so as to be deemed non-responsive.

Dated the _____ day of _____, 20....

Thanking you,

We remain,

Yours faithfully,

Name, Designation and Signature of Authorized Person in whose name Power of Attorney/ Board Resolution/ Declaration. Copy of Power of Attorney/ Board Resolution/ Declaration should be enclosed along with Covering Letter.

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Form F-1

BIDDER'S GENERAL INFORMATION

(To be submitted on the Letter Head of the Bidding Company)

Sr. No.	Description	Remarks
1	Name of the Bidder (Incase of JV/ Consortium, name of all the members to be indicated and lead member to be identified)	
2	Status of the Firm	
3	Mailing Address of Registered Office	
4	Mailing Address of Operation Office	
5	E-mail	
6	Web site	
7	Authorized Contact Person(s) with Name, Designation, Address and Mobile Phone No., E-mail address / Fax No. to whom all references shall be made	
8	Year of Incorporation	
9	Number of Years in Operation	
10	ISO Certification Yes/No	
11	Name of the Banker	
12	Branch Details of Bank	
13	Type of Account with Account Number	
14	IFSC Code	
15	Permanent Account Number (PAN) of the Bidder	(Copy of PAN Card to be enclosed)
16	Whether the Vendor is registered/ Likely to be registered under GST	Yes or No :

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		If Yes, then customer will be treated as registered customer & he will have to provide further details as stated on the below left hand side
17	GST ID (Proof to be submitted – GST No acknowledgement OR Email from GoI)	
18	GSTN Address	

Sr. No.	Description	Remarks
19	PF Registration Number with Details	(Copy of Registration to be enclosed)
20	ESI Registration Number with Details	(Copy of Registration to be enclosed)
21	Have the Bidder/ Company ever been debarred by any Govt. Dept./ Undertaking for undertaking any work	Yes/No (If answer is YES, please provide details)
22	Reference of any document information attached by the Bidder other than specified in the tender.	
23	Whether the Bidder wishes to form a Project Company for execution of work	Yes/No
24	Bidding company is listed in India	Yes/No
25	Whether company is MSME as on the bidding date	Yes/No

(Signature of Authorized Signatory)

With Stamp

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Form F-2

**Indemnity Bond to be executed by The Contractor for The Removal / Disposal of
Scrap/Disposal of Surplus Material**

(TO BE EXECUTED ON STAMP PAPER OF APPROPRIATE VALUE)

INDEMNITY BOND

This INDEMNITY BOND executed this day of 20..... by(Name of Company)....., a Company registered under the Companies Act, 1956/2013 Concern and having its registered office(s) at(Office Address)....., hereinafter called the Indemnifier(s)/ Contractor(s) (which expression shall, unless excluded by or repugnant to the context, be deemed to mean and include its successors, administrators and executors).

IN FAVOUR OF

M/s , having its registered office at.....(hereinafter referred to as “.....”)

1. M/s..... has awarded the Contractor(s), contract for execution of work (“Scope of Work”) as mentioned in the NOA/contract agreement no..... dated , entered into between M/s and Contractor(s), relating to(Name & Address of Project/Station)..... (hereinafter called ‘the Project’).

2. The Indemnifier(s) for the purpose of execution of its Scope of Work had from time to time procured and stored(Details of Material)..... at the Project Site.

3. After completion of the Scope of Work by Indemnifier(s), it has been identified that scrap (Details of Scrap Material & its Quantity).....and/or surplus (Details of Surplus Material & its Quantity)..... belonging to Indemnifier(s) is lying at the said Project Site.

4. Now, the scrap (Details of Scrap Material & its Quantity).....and/or surplus (Details of Surplus Material & its Quantity)..... belonging to the Indemnifier(s), requires to be removed by Indemnifier(s) from the Project Site.

NOW THEREFORE THIS INDEMNITY BOND WITNESSETH AS UNDER:

1. That Indemnifier(s) by way of this indemnity requests M/s..... to issue approval in favour of Indemnifier(s) for removal of scrap(Details of Scrap Material & its Quantity).....and/or

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surplus(Details of Surplus Material & its Quantity)..... belonging to Indemnifier(s), from the project.

2. That the Indemnifier(s) shall ensure clearing of its scrap (Details of Scrap Material & its Quantity).....and/or surplus (Details of Surplus Material & its Quantity)..... by itself, as aforesaid.

3. That Indemnifier(s) in consideration of the premises above, for itself and its respective, executors, administrators and assigns, jointly and severally agree and undertake from time to time and at all times hereafter to indemnify M/s..... and keep M/s..... indemnified from and against all claims, demands, actions, liabilities and expenses which may be made or taken against or incurred by M/s..... by reason of the issue of necessary approval by M/s..... and permitting Indemnifier(s) to remove scrap(Details of Scrap Material & its Quantity).....and/or surplus(Details of Surplus Material & its Quantity)..... belonging to Indemnifier(s), from the project.

4. That Indemnifier(s) undertakes to indemnify and keep M/s..... harmless from any act of omission or negligence on the part of the Contractor in following the statutory requirements with regard to removal/disposal of scrap and surplus belonging to Indemnifier(s), from the Project Site aforesaid, by the Indemnifier(s). Further, in case the laws require M/s..... to take prior permission of the relevant Authorities before handing over the scrap and/or surplus to the Indemnifier, the same shall be obtained by the Indemnifier on behalf of M/s.....

IN WITNESS WHEREOF, the Indemnifier(s), through its authorized representative, has executed these presents on the Day, Month and Year first mentioned above at

.....(Name of the Place).....

Witness:

Indemnifier

1.

2.

(Authorised Signatory)

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Form F-3

**INDEMNITY BOND TO BE EXECUTED BY THE CONTRACTOR FOR THE PLANT
HANDED OVER FOR PERFORMANCE OF ITS O&M CONTRACT (ENTIRE SOLAR
PHOTO VOLTAIC PLANT)**

(TO BE EXECUTED ON STAMP PAPER OF APPROPRIATE VALUE)

INDEMNITY BOND

THIS INDEMNITY BOND IS made this..... day of 20..... by
..... a Company registered under the Companies Act, 1956/2013 concern
having its Registered Office at..... (hereinafter called
as "Contractor" or "Obligor" which expression shall include its successors) in favour of M/s....., a
Company incorporated under the Companies Act, 1956 having its Registered Office at
..... and its Project at(hereinafter called "M/s....." which
expression shall include its successors and assigns) :

WHEREAS M/s..... has awarded to the Contractor a Contract for
..... vide its Letter of NOA/Contract Agreement No..... dated
and its Amendment No..... (Applicable when amendments have been
issued) (hereinafter called the "Contract") in terms of which M/s.... is required to hand over
various Equipment and facilities provided under Supply & Service Contract , herein after called
"Solar Photo Voltaic Plant" to the Contractor for execution of the Contract.

AND WHEREAS, The Contractor is required to execute an Indemnity Bond in favour of M/s.....
for the Solar Photo Voltaic Plant handed over to it by M/s..... for the purpose of Performance of
the Contract/O&M portion of the Contract.

NOW, THEREFORE, this Indemnify Bond witnesseth as follows:

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1. That in consideration of Solar Photo Voltaic Plant as mentioned in the Contract, Valued at Rs.....#..... (Rupees.....) handed over to the Contractor for the purpose of Performance of the Contract, the Contractor hereby undertakes to indemnify and shall keep M/s... indemnified, for the full value of the Solar Photo Voltaic Plant. The Contractor hereby acknowledges actual receipt of the Solar Photo Voltaic Plant as detailed in the Schedule appended hereto. The Contractor shall hold such Solar Photo Voltaic Plant in trust as a "Trustee" for and on behalf of M/s.....
2. That the Contractor is obliged and shall remain absolutely responsible for the safe O&M/protection and custody of the Solar Photo Voltaic Project against all risks whatsoever till completion of O&M Contract in accordance with the terms of the Contract and is taken over by M/s..... The Contractor undertakes to keep M/s..... harmless against any loss or damage that may be caused to the Solar Photo Voltaic Plant.
3. The Contractor undertakes that the Solar Photo Voltaic Plant shall be used exclusively for the Performance/execution of the Contract strictly in accordance with its terms and conditions and no part of the Solar Photo Voltaic Plant shall be utilised for any other work or purpose whatsoever. It is clearly understood by the Contractor that non-observance of the obligations under this Indemnify Bond by the Contractor shall inter-alia constitute a criminal breach of trust on the part of the Contractor for all intents and purposes including legal/penal consequences.
4. That M/s.... is and shall remain the exclusive owner of the Solar Photo Voltaic Plant free from all encumbrances, charges or liens of any kind, whatsoever. The Solar Photo Voltaic Plant shall at all times be open to inspection and checking by Engineer-in-Charge/Engineer or other employees /agents authorised by him in this regard. Further, M/s... shall always be free at all times to take possession of the Solar Photo Voltaic Plant in whatever form the Solar Photo Voltaic Plant may be, if in its opinion, the Solar Photo Voltaic Plant are likely to be endangered, mis-utilised 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 itself and undertakes to comply with the directions of demand of M/s... to return the Solar Photo Voltaic Plant without any demur or reservation.
5. That this Indemnify Bond is irrevocable. If at any time any loss or damage occurs to the Solar Photo Voltaic Plant or the same or any part thereof is mis- utilised in any manner whatsoever, then the Contractor hereby agrees that the decision of the Engineer-in-

5 MW (AC) SPV Project	<u>Tender No</u> <u>SECI/C&P/PMC/11/0001/2021-22</u>	<u>SFF</u> <u>Page 13 of 60</u>	<u>Signature of</u> <u>Bidder</u>
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Charge/Engineer of M/s.... as to assessment of loss or damage to the Solar Photo Voltaic Plant shall be final and binding on the Contractor. The Contractor binds itself and undertakes to replace the lost and/or damaged Solar Photo Voltaic Plant at its own cost and / or shall pay the amount of loss to M/s.... without any demur, reservation or protest. This is without prejudice to any other right or remedy that may be available to M/s.... against the Contractor under the Contract and under this Indemnify Bond.

6. NOW THE CONDITION of this Bond is that if the Contractor shall duly and punctually comply with the terms of and conditions of this Bond to the satisfaction of M/s..., THEN, the above Bond shall be void, but otherwise, it shall remain in full force and virtue.

IN WITNESS WHEREOF, the Contractor has hereunto set its hand through its authorised representative under the common seal of the Company, the day, month and year first above mentioned

SCHEDULE

Particulars of the Equipment / Facilities handed-over	Quantity	Value	Other details, (if any)	Signature of Attorney in token of receipt

WITNESS

For and on behalf of

M/s.

5 MW (AC) SPV Project	<u>Tender No</u> <u>SECI/C&P/PMC/11/0001/2021-22</u>	<u>SFF</u> <u>Page 14 of 60</u>	<u>Signature of</u> <u>Bidder</u>
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I. 1. Signature ----- Name -----

2. Name ----- Signature -----

3. Address ----- Designation -----

Authorised representative*

II. 1. Signature -----

2. Name ----- Common Seal
(In case of Company)

3. Address -----

* Indemnity Bonds are to be executed by the authorised persons and (i) In case of contracting Company under common seal of the Company of (ii) having the power of attorney issued under common seal of the company with authority to execute Indemnity Bonds, (iii) In case (ii) the original Power of Attorney if it is specifically for our contract or a Photostat copy of the Power of Attorney if it is a General Power of Attorney and such documents should be attached to Indemnity Bond.

The value shall be sum of Supply and Erection Contract value.

5 MW (AC) SPV Project	<u>Tender No</u> <u>SECI/C&P/PMC/11/0001/2021-22</u>	<u>SFF</u> <u>Page 15 of 60</u>	<u>Signature of</u> <u>Bidder</u>
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Form F-4A**PROFORMA OF BANK GUARANTEE FOR EARNEST MONEY DEPOSIT (EMD) :**

(To be on non-judicial stamp paper of appropriate value as per Stamp Act relevant to place of execution.)

Ref. _____

Bank Guarantee No. _____

Date: _____

In consideration of the -----[Insert name of the Bidder] (hereinafter referred to as 'Bidder') submitting the response to NIT inter alia for selection of the Project in response to the NIT No. _____ dated ____ issued by Solar Energy Corporation of India Limited (hereinafter referred to as SECI) and SECI considering such response to the NIT of[insert the name of the Bidder] as per the terms of the NIT, the _____ [insert name & address of bank] hereby agrees unequivocally, irrevocably and unconditionally to pay to SECI at [Insert Name of the Place from the address of SECI] forthwith on demand in writing from SECI or any Officer authorized by it in this behalf, any amount upto and not exceeding Rupees -----[Insert amount] only, on behalf of M/s. _____ [Insert name of the Bidder] .

This guarantee shall be valid and binding on this Bank up to and including _____ [insert date of validity in accordance with NIT] and shall not be terminable by notice or any change in the constitution of the Bank or the term of contract or by any other reasons whatsoever and our liability hereunder shall not be impaired or discharged by any extension of time or variations or alternations made, given, or agreed with or without our knowledge or consent, by or between parties to the respective agreement.

Our liability under this Guarantee is restricted to Rs. _____ (Rs. _____ only). Our Guarantee shall remain in force until _____ [insert date of validity in accordance with NIT]. SECI shall be entitled to invoke this Guarantee till _____ [Insert date which is 30 days after the date in the preceding sentence].

The Guarantor Bank hereby agrees and acknowledges that the SECI shall have a right to invoke this BANK GUARANTEE in part or in full, as it may deem fit.

The Guarantor Bank hereby expressly agrees that it shall not require any proof in addition to the written demand by SECI, made in any format, raised at the above-mentioned address of the Guarantor Bank, in order to make the said payment to SECI.

The Guarantor Bank shall make payment hereunder on first demand without restriction or conditions and notwithstanding any objection by ----- [Insert name of the Bidder] and/or any other person.

5 MW (AC) SPV Project	Tender No SECI/C&P/PMC/11/0001/2021-22	SAMPLE FORMS Page 16 of 60	Signature of Bidder
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The Guarantor Bank shall not require SECI to justify the invocation of this BANK GUARANTEE, nor shall the Guarantor Bank have any recourse against SECI in respect of any payment made hereunder.

This BANK GUARANTEE shall be interpreted in accordance with the laws of India and the courts at Delhi shall have exclusive jurisdiction.

The Guarantor Bank represents that this BANK GUARANTEE has been established in such form and with such content that it is fully enforceable in accordance with its terms as against the Guarantor Bank in the manner provided herein.

This BANK GUARANTEE shall not be affected in any manner by reason of merger, amalgamation, restructuring or any other change in the constitution of the Guarantor Bank.

This BANK GUARANTEE shall be a primary obligation of the Guarantor Bank and accordingly SECI shall not be obliged before enforcing this BANK GUARANTEE to take any action in any court or arbitral proceedings against the Bidder, to make any claim against or any demand on the Bidder or to give any notice to the Bidder or to enforce any security held by SECI or to exercise, levy or enforce any distress, diligence or other process against the Bidder.

Notwithstanding anything contained hereinabove, our liability under this Guarantee is restricted to Rs. _____ (Rs. _____ only) and it shall remain in force until _____

[Date to be inserted on the basis of this NIT] with an additional claim period of thirty (30) days thereafter.

We are liable to pay the guaranteed amount or any part thereof under this Bank Guarantee only if SECI serves upon us a written claim or demand.

Signature _____

Name _____

Power of Attorney No. _____

For

_____[Insert Name of the Bank]____

Banker's Stamp and Full Address.

Dated this ____ day of ____, 20__

Bank Contact Details & E Mail ID is to be provided

5 MW (AC) SPV Project	<u>Tender No</u> <u>SECI/C&P/PMC/11/0001/2021-22</u>	<u>SAMPLE FORMS</u> <u>Page 17 of 60</u>	<u>Signature of</u> <u>Bidder</u>
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Form F-5

(TO BE EXECUTED ON STAMP PAPER OF APPROPRIATE VALUE)

INDEMNITY BOND

THIS INDEMNITY BOND IS made this..... day of 20..... by **M/s.**, a Company registered under the Companies Act, 1956/ having its Registered Office at(hereinafter called as "Contractor" or "Obligor" which expression shall include its successors) in favour of M/s, a Company incorporated under the Companies Act, 1956/2013 having its Registered Office at and their authorised representatives/Employer i.e., Solar Energy Corporation of India Limited (SECI) and its Project athereinafter called "....." which expression shall include its successors and assigns) :

WHEREAS/ SECI has awarded to the Contractor a Contract vide its NOA NoDated & Contract Agreement No.....dated.....executed on (hereinafter called the "Contract").

NOW, THEREFORE, this Indemnify Bond witnesseth as follows:

1. That in consideration of Solar Photo Voltaic Plant as mentioned in the Contract, total valued at Rs. (Rupees only), valued as a summation of the referred contracts and handed over to the Contractor for the purpose of Performance of the Contract (s), the Contractor hereby undertakes to indemnify and shall keep M/s..... and their authorized representatives/Employer i.e., SECI, indemnified, for the full value of the Solar Photo Voltaic Plant during the tenure of this contract or its extension if agreed to.
2. Contractor confirm that they are aware of all the contractual obligations regarding payment to all personnel and labours including that of the sub – vendors & sub –contractors of Contractor, involved in this project., as well as various contractual, statutory and non – statutory obligations as per legal requirements and have complied with the obligations to the best of information and knowledge.

5 MW (AC) SPV Project	<u>Tender No</u> SECI/C&P/PMC/11/0001/2021-22	<u>SAMPLE FORMS</u> Page 18 of 60	<u>Signature of Bidder</u>
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3. Contractor also confirms, that they are in compliance of all the provisions and requirements, including but not limited to, the following acts/ laws/ provisions and other applicable statutory and non-statutory regulations:
 - a. Contract Labor (Regulation & Abolition) Act 1970
 - b. Wages Act 1936
 - c. Minimum Wages Act 1948
 - d. Employer's Liability Act 1938
 - e. Workmen's Compensation Act 1923
 - f. Industrial Dispute Act 1947
 - g. Maturity Benefit Act 1961
 - h. Mines Act 1952
 - i. Employees State Insurance Act 1948.
4. Contractor, hereby confirm, that in the event any contractual or statutory obligation is found to be deficient in compliance or found non-complied, Contractor will indemnify M/s...../ SECI and take necessary actions to comply with the same within the permissible time period.
5. Contractor also confirm, should there be any charges or penalty, of any kind imposed on M/s.... or its authorized representatives i.e., SECI, for non-compliance of legal or statutory requirements by Contractor during its tenure of the contract, Contractor agrees to indemnify M/s..... and SECI against all damages, libel or suit, in full for the same on raising such a demand by M/s...../ SECI and promises to pay the same within 30 days.
6. We do further undertake that this above stated warranty is inclusive of materials and labour.
7. That the Contractor is obliged and shall remain absolutely responsible for the safe O&M/ protection and custody of the Solar Photo Voltaic Project against all risks whatsoever till completion of O&M Contract in accordance with the terms of the Contract. The Contractor undertakes to keep M/s..... and SECI harmless against any loss or damage that may be caused to the Solar Photo Voltaic Plant.

5 MW (AC) SPV Project	<u>Tender No</u> SECI/C&P/PMC/11/0001/2021-22	<u>SAMPLE FORMS</u> Page 19 of 60	<u>Signature of</u> Bidder
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IN WITNESS WHEREOF, the Contractor has hereunto set its hand through its authorised representative under the common seal of the Company, the day, month and year first above mentioned

For Jakson Engineers Limited

(_____)

Designation: Director

Name:

Date:

(Authorized Representative of JEL)

5 MW (AC) SPV Project	<u>Tender No</u> <u>SECI/C&P/PMC/11/0001/2021-22</u>	<u>SAMPLE FORMS</u> <u>Page 20 of 60</u>	<u>Signature of</u> <u>Bidder</u>
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Form F-6**NO DEVIATION CONFIRMATION**
(To be submitted on the Letter Head of the Bidding Company)

Ref.No. _____

Date: _____

From: _____ (*Insert name and address of Bidding Company*)

Tel. #:

Fax #:

E-mail address#

To

Solar Energy Corporation of India Limited

(A Government of India Enterprise)

6th Floor, Plate-B, NBCC Office Block Tower-2, East Kidwai Nagar, New Delhi-110023, India

Sub: Bid for the "Tender for Design, Engineering, Supply, Construction, Erection, Testing & Commissioning of 5 MW (AC) grid connected ground based Solar PV Power Plant including 10 years plant O&M at V. O. Chidambaranar Port Trust, Tuticorin, Tamilnadu, India".

Dear Sir / Madam,

We understand that any 'deviation/ exception' in any form may result in rejection of bid. We, therefore, certify that we have not taken any 'exception/ deviation' anywhere in the bid and we agree that if any 'deviation/ exception' is mentioned or noticed, our bid may be rejected.

Place:

Date:

[Signature of Authorized Signatory of Bidder]

Name:

Designation:

Seal:

5 MW (AC) SPV Project	<u>Tender No</u> <u>SECI/C&P/PMC/11/0001/2021-22</u>	<u>SAMPLE FORMS</u> <u>Page 21 of 60</u>	<u>Signature of</u> <u>Bidder</u>
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Form F-7**DECLARATION REGARDING BANNING, LIQUIDATION, COURT RECEIVERSHIP ETC.****(To be submitted on the Letter Head of the Bidding Company)**

Ref.No. _____

Date: _____

From: _____ (Insert name and address of Bidding Company)

Tel.#: _____

Fax#: _____

E-mail address# _____

To

Solar Energy Corporation of India Limited

(A Government of India Enterprise)

6th Floor, Plate-B, NBCC Office Block Tower-2, East Kidwai Nagar, New Delhi-110023, India

Sub: Bid for the "Tender for Design, Engineering, Supply, Construction, Erection, Testing & Commissioning of 5 MW (AC) grid connected ground based Solar PV Power Plant including 10 years plant O&M at V. O. Chidambaranar Port Trust, Tuticorin, Tamilnadu, India".

Dear Sir / Madam,

We hereby confirm that we are not on Banning List by Employer/ Owner or Public Sector Project Management Consultant due to "poor performance" or "corrupt and fraudulent practices" or any other reason or banned by Government department/ Public Sector on due date of submission of bid.

Further, we confirm that neither we nor our allied agency/(ies) (as defined in the Procedure for Action in case of Corrupt/ Fraudulent/ Collusive/ Coercive Practices) are on banning list of Employer/ Owner or the Ministry of New & Renewable Energy.

We also confirm that we are not under any liquidation, court receivership or similar proceedings or 'bankruptcy'.

In case it comes to the notice of Employer/ Owner that we have given wrong declaration in this regard, the same shall be dealt as 'fraudulent practices' and action shall be initiated as per the Procedure for action in case of Corrupt/Fraudulent/Collusive/Coercive Practices.

Further, we also confirm that in case there is any change in status of the declaration prior to award of contract, the same will be promptly informed to Employer/ Owner by us.

Place: _____

[Signature of Authorized Signatory of Bidder]

Date: _____

Name: _____

Designation: _____

Seal: _____

5 MW (AC) SPV Project	<u>Tender No</u> <u>SECI/C&P/PMC/11/0001/2021-22</u>	<u>SAMPLE FORMS</u> <u>Page 22 of 60</u>	<u>Signature of</u> <u>Bidder</u>
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Form F-8**DECLARATION****RESTRICTION ON PROCUREMENT FROM CERTAIN
COUNTRIES:****MoF OM No 6/18/2019-PPD dated 23.07.2020****(This should be submitted on the Letter Head of the Bidding Company/ Each Member
of Consortium)**

Ref.No. _____

Date: _____

From: _____ (Insert name and address of Bidding Company/ Lead Member of Consortium)

Tel.#: Fax#:

E-mail address#

To

Solar Energy Corporation of India Limited

6th Floor, Plate-B, NBCC Office Block Tower-2, East Kidwai Nagar, New Delhi-110023, India

Sub: Response to the Tender No datedfor the tender for
.....
.....

Dear Sir/ Madam,

This is with reference to attached order No. OM no. 6/18/2019-PPD dated 23rd July 2020 issued by
Department of Expenditure, MoF, Govt of India.**Bidders are required to submit the relevant Declaration 1 And/or 2. Kindly
provide the relevant declaration(s) pertaining to you.**

We are hereby submitting the following declaration in this regard:

5 MW (AC) SPV Project	<u>Tender No</u> <u>SECI/C&P/PMC/11/0001/2021-22</u>	<u>SAMPLE FORMS</u> <u>Page 23 of 60</u>	<u>Signature of</u> <u>Bidder</u>
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Any Bidder (including its JV partner/Consortium Member, wherever applicable) from a country which shares a land border with India will be eligible to bid in this tender only if bidder is registered with the Competent Authority which is the Registration Committee constituted by the Department for Promotion of Industry & Internal Trade (DPIIT) in line with the MoF OM No 6/18/2019-PPD dated 23.07.2020. Further the successful bidder shall not be allowed to subcontract supplies/services/works to any "Sub-contractor" under "Second Contract" i.e Service Contract, from a country which shares a land border with India unless such Subcontractor is registered with the competent as mentioned above.

The Contractor shall not be allowed to sub-contract works to any sub-contractor/ sub-vendor from a country which shares a land border with India unless such sub-contractor is registered with the competent Authority. However, the same shall not be applicable for "First Contract i.e. Supply Contract".

However, the said requirement of registration will not apply to bidders/sub- contractors from those countries (even if sharing a land border with India) to which the Government of India has extended lines of credit or in which the Government of India is engaged in development projects. Bidders may apprise themselves of the updated lists of such countries available in the website of the Ministry of External Affairs.

Declaration 1:

Certification for Tenders

"I have read the clause regarding restrictions on procurement from a bidder of a country which shares a land border with India; I certify that this bidder is not from such a country or, if from such a country, has been registered with the Competent Authority. I hereby certify that this bidder fulfils all requirements in this regard and is eligible to be considered. Where applicable, evidence of valid registration by the Competent Authority shall be attached]."

And

Declaration 2:

Certification for Tenders for Works involving possibility of sub-contracting (Applicable for Second Contract" i.e Service Contract)

"I have read the clause regarding restrictions on procurement from a bidder of a country which shares a land border with India and on sub-contracting to contractors from such countries; I certify that this bidder is not from such a country or, if from such a country, has been registered with the Competent Authority and will not sub-contract any work to a contractor from such countries unless such contractor is registered with the Competent Authority. I hereby certify that this bidder fulfils all requirements in this regard and is eligible to be considered. [Where applicable, evidence of valid registration by the Competent Authority shall be attached]."

We further declare that the above statement is true & correct. We are aware that if at any stage it is found to be incorrect, our response to the tender will be rejected.

5 MW (AC) SPV Project	Tender No <u>SECI/C&P/PMC/11/0001/2021-22</u>	SAMPLE FORMS <u>Page 24 of 60</u>	Signature of <u>Bidder</u>
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Dated the _____ day of _____, 20....

Thanking you,

We remain,
Yours faithfully,

Name, Designation, Seal and Signature of Authorized Person in whose name Power of Attorney/ Board Resolution/ Declaration.

5 MW (AC) SPV Project

Tender No
SECI/C&P/PMC/11/0001/2021-22

SAMPLE FORMS
Page 25 of 60

Signature of
Bidder

Form F-9**FORMAT FOR PERFORMANCE SECURITY BANK
GAURANTEE**

(To be on non-judicial stamp paper of appropriate value as per Stamp Act relevant to place of execution.)

Ref. _____

Bank Guarantee No. _____

Date: _____

In consideration of the -----[Insert name of the Bidder] (hereinafter referred to as 'Bidder') submitting the response to NIT inter alia for selection of the Project in response to the NIT No. _____ dated ____ issued by Solar Energy Corporation of India Limited (hereinafter referred to as SECI) and SECI considering such response to the NIT of[insert the name of the Bidder] as per the terms of the NIT, the _____ [insert name & address of bank] hereby agrees unequivocally, irrevocably and unconditionally to pay to SECI at [Insert Name of the Place from the address of SECI] forthwith on demand in writing from SECI or any Officer authorized by it in this behalf, any amount upto and not exceeding Rupees -----[Insert amount] only, on behalf of M/s. _____ [Insert name of the Bidder] .

This guarantee shall be valid and binding on this Bank up to and including _____ [insert date of validity in accordance with NIT] and shall not be terminable by notice or any change in the constitution of the Bank or the term of contract or by any other reasons whatsoever and our liability hereunder shall not be impaired or discharged by any extension of time or variations or alternations made, given, or agreed with or without our knowledge or consent, by or between parties to the respective agreement.

Our liability under this Guarantee is restricted to Rs. _____ (Rs. _____ only). Our Guarantee shall remain in force until _____ [insert date of validity in accordance with NIT]. SECI shall be entitled to invoke this Guarantee till _____ [Insert date which is 30 days after the date in the preceding sentence].

The Guarantor Bank hereby agrees and acknowledges that the SECI shall have a right to invoke this BANK GUARANTEE in part or in full, as it may deem fit.

The Guarantor Bank hereby expressly agrees that it shall not require any proof in addition to the written demand by SECI, made in any format, raised at the above-mentioned address of the Guarantor Bank, in order to make the said payment to SECI.

The Guarantor Bank shall make payment hereunder on first demand without restriction or conditions and notwithstanding any objection by ----- [Insert name of the Bidder] and/or any other person.

5 MW (AC) SPV Project	<u>Tender No</u> SECI/C&P/PMC/11/0001/2021-22	<u>SAMPLE FORMS</u> Page 26 of 60	<u>Signature of</u> Bidder
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The Guarantor Bank shall not require SECI to justify the invocation of this BANK GUARANTEE, nor shall the Guarantor Bank have any recourse against SECI in respect of any payment made hereunder.

This BANK GUARANTEE shall be interpreted in accordance with the laws of India and the courts at Delhi shall have exclusive jurisdiction.

The Guarantor Bank represents that this BANK GUARANTEE has been established in such form and with such content that it is fully enforceable in accordance with its terms as against the Guarantor Bank in the manner provided herein.

This BANK GUARANTEE shall not be affected in any manner by reason of merger, amalgamation, restructuring or any other change in the constitution of the Guarantor Bank.

This BANK GUARANTEE shall be a primary obligation of the Guarantor Bank and accordingly SECI shall not be obliged before enforcing this BANK GUARANTEE to take any action in any court or arbitral proceedings against the Bidder, to make any claim against or any demand on the Bidder or to give any notice to the Bidder or to enforce any security held by SECI or to exercise, levy or enforce any distress, diligence or other process against the Bidder.

Notwithstanding anything contained hereinabove, our liability under this Guarantee is restricted to Rs. _____ (Rs. _____ only) and it shall remain in force until _____

[Date to be inserted on the basis of this NIT] with an additional claim period of thirty (30) days thereafter.

We are liable to pay the guaranteed amount or any part thereof under this Bank Guarantee only if SECI serves upon us a written claim or demand.

Signature _____

Name _____

Power of Attorney No. _____

For

_____[Insert Name of the Bank]____

Banker's Stamp and Full Address.

Dated this ____ day of ____, 20__

Bank Contact Details & E Mail ID is to be provide

5 MW (AC) SPV Project	<u>Tender No</u> <u>SECI/C&P/PMC/11/0001/2021-22</u>	<u>SAMPLE FORMS</u> <u>Page 27 of 60</u>	<u>Signature of</u> <u>Bidder</u>
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Form F-13

BIDDER'S EXPERIENCE

(To be submitted on the Letter Head of the Bidding Company)

Ref.No. _____

Date: _____

From: _____ (Insert name and address of Bidding Company)

Tel.#: _____

Fax#: _____

E-mail address# _____

To

Solar Energy Corporation of India Limited

(A Government of India Enterprise)

6th Floor, Plate-B, NBCC Office Block Tower-2, East Kidwai Nagar, New Delhi-110023, India

Sub: Bid for "Tender for Design, Engineering, Supply, Construction, Erection, Testing & Commissioning of 5 MW (AC) grid connected ground based Solar PV Power Plant including 10 years plant O&M at V. O. Chidambaranar Port Trust, Tuticorin, Tamilnadu, India".

Dear Sir / Madam,

Sl. No	Description of the Services	LOA /WO No. and date	Full Address & phone nos. of Client. Name, designation and address of Engineer/ Officer-in-Charge (for cases other than purchase)	Postal & phone nos. of Client.	Value of Contract/ Order (Specify Currency Amount)	Date of Commencement of Services	Scheduled Completion Time (Months)	Date of Actual Completion	Reasons for delay in execution, if any
(1)	(2)	(3)	(5)	(6)	(7)	(8)	(9)	(10)	

Place:

Date:

[Signature of Authorized Signatory of Bidder]

Name:

Designation:

Seal

5 MW (AC) SPV Project	Tender No SECI/C&P/PMC/11/0001/2021-22	SAMPLE FORMS Page 28 of 60	Signature of Bidder
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Form F-14**Format for Disclosure for ALMM compliance****[On the letter head of Bidding Company/ Lead Member in a Bidding JV/Consortium]****Disclosure**

Ref.No. _____

Date: _____

From: _____ (Insert name and address of Bidding Company/ Lead Member of JV/Consortium)

To

Solar Energy Corporation of India Limited

(A Government of India Enterprise)

6th Floor, Plate-B, NBCC Office Block Tower-2, East Kidwai Nagar,
New Delhi-110023, India**Sub: Response to Tender No.dated for the Design, Engineering, Supply, Construction, Erection, Testing & Commissioning of 100 MW (AC) Solar PV Project with Land having 10 years plant O&M at Chhattisgarh, India**

Dear Sir/ Madam,

We declare that we are fully aware of the binding provisions of the ALMM Order and the Lists(s) thereunder, while quoting the for the subject tender of Tender for Design, Engineering, Supply, Construction, Erection, Testing & Commissioning of 5 MW (AC) grid connected ground based Solar PV Power Plant including 10 years plant O&M at V. O. Chidambaranar Port Trust, Tuticorin, Tamilnadu, India.

We further understand that the List-I (Solar PV Modules) of ALMM Order, Annexure-I of the OM, issued by MNRE on 10th March, 2021 will be updated by MNRE from time to time. We also understand that the Modules to be procured for this project, shall be from the List-I of the ALMM Order applicable on the date of invoicing of such modules.

We also further understand and accept that we shall be liable for penal action, including but not limited to blacklisting and invocation of Performance Bank Guarantee, if we are found not complying with the provisions of ALMM Order, including those mentioned above.

Dated the _____ day of _____, 20....

Thanking you,
We remain,

5 MW (AC) SPV Project	<u>Tender No</u> <u>SECI/C&P/PMC/11/0001/2021-22</u>	<u>SAMPLE FORMS</u> <u>Page 29 of 60</u>	<u>Signature of</u> <u>Bidder</u>
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Yours faithfully,

Name, Designation, Seal and Signature of Authorized Signatory

Form F-16

FORMAT OF CHARTERED ACCOUNTANT CERTIFICATE
FOR FINANCIAL CAPABILITY OF THE BIDDER
(To be submitted on the Letter Head of the Chartered Accountant)

Ref.No. _____

Date: _____

To

Solar Energy Corporation of India Limited

(A Government of India Enterprise)

6th Floor, Plate-B, NBCC Office Block Tower-2, East Kidwai Nagar, New Delhi-110023, India

Sub: Bid for "Tender for Design, Engineering, Supply, Construction, Erection, Testing & Commissioning of 5 MW (AC) grid connected ground based Solar PV Power Plant including 10 years plant O&M at V. O. Chidambaranar Port Trust, Tuticorin, Tamilnadu, India".

Dear Sir / Madam,

We have verified the Annual Accounts and other relevant records of M/s..... (Name of the bidder) and certify the following

Further, we certify that the Financially Evaluated Entity (ies) had an Annual Turnover

A. ANNUAL TURNOVER OF LAST 3 YEARS:

Year	Amount (Currency)
Year 1:	
Year 2:	
Year 3:	

And

Net worth (strike out whichever is not applicable) of INR.....Crore computed as per instructions provided in this tender based on unconsolidated audited annual accounts as per last FY.

5 MW (AC) SPV Project	<u>Tender No</u> <u>SECI/C&P/PMC/11/0001/2021-22</u>	<u>SAMPLE FORMS</u> <u>Page 30 of 60</u>	<u>Signature of</u> <u>Bidder</u>
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B. FINANCIAL DATA FOR LAST AUDITED FINANCIAL YEAR:

Description	Year _____
	Amount (Currency)
1. Current Assets	
2. Current Liabilities	
3. Working Capital (Current Assets- Current liabilities)	
4. Net Worth (As mentioned under Annexure to BDS)	

Yours faithfully

(Signature and stamp (on each page) of Authorized Signatory of Bidding Company.

Name:

Date:

Place:

Signature and stamp (on each page) of Chartered Accountant/Statutory Auditors of Bidding Company.

Name:

Date:

Place:

Notes:

Audited consolidated annual accounts of the Bidder may also be used for the purpose of financial criteria provided the Bidder has at least 50% equity in each company whose accounts are merged in the audited consolidated accounts and provided further that the financial capability of such companies (of which accounts are being merged in the consolidated accounts) shall not be considered again for the purpose of evaluation of the Bid.

5 MW (AC) SPV Project	<u>Tender No</u> <u>SECI/C&P/PMC/11/0001/2021-22</u>	<u>SAMPLE FORMS</u> <u>Page 31 of 60</u>	<u>Signature of</u> <u>Bidder</u>
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Form F-17

FORMAT FOR JOINT VENTURE AGREEMENT

(To be stamped in accordance with Stamp Act, the Non-Judicial Stamp Paper of Appropriate Value should be in the name of the Joint Venture)

THIS JOINT DEED OF UNDERTAKING executed on this..... day of..... Two Thousand and..... by a company incorporated under the laws of and having its Registered Office at(hereinafter called the "Party No.1" which expression shall include its successors & executors) and M/s.....a company incorporated under the laws of and having its Registered Office at (hereinafter called the "Party No.2" which expression shall include its successors & executors) and M/s..... a Company incorporated under the laws of and having its Registered Office at (hereinafter called the "Party No.3" which expression shall include its successors & executors) for the purpose of making a bid and entering into a contract [hereinafter called the "Contract" {in case of award}] against the Tender No..... for (insert name of the package alongwith project name) of Solar Energy Corporation of India Limited, a Company incorporated under the Companies Act of 2013 having its registered office at 6th Floor, Plate-B, NBCC Office Block Tower-2, East Kidwai Nagar, New Delhi-110023, India (hereinafter called the "Employer").

WHEREAS the Party No.1, Party No.2 and Party No.3 have entered into an Agreement dated.....

AND WHEREAS the Employer invited bids as per the above-mentioned Specification for the design, manufacture, supply, erection, testing and commissioning including O & M of Equipment/ Materials stipulated in the Tender Documents under (insert name of the package alongwith project name)

AND WHEREAS Clause 2, Section-ITB and BDS (documents establishing the Qualification of Bidder) & Qualification Criteria in Annexure to BDS forming part of the Tender Documents, inter-alia stipulates that an Undertaking of two or more qualified manufacturers as partners, meeting the requirements of Qualification Criteria in Annexure to BDS, as applicable may bid, provided, the Joint Venture fulfills all other requirements under Qualification Criteria in Annexure to BDS and in such a case, the Bid Forms shall be signed by all the partners so as to legally bind all the Partners of the Joint Venture, who will be jointly and severally liable to perform the Contract and all obligations hereunder.

The above clause further states that this Undertaking shall be attached to the bid and the Contract Performance Security will be as per the format F-9 enclosed with the Tender Documents without any restrictions or liability for either party.

AND WHEREAS the bid is being submitted to the Employer vide proposal No..... dated by Party No.1 based on this Undertaking between all the parties; under these presents and the bid in accordance with the requirements of Clause 2, Section-ITB and BDS (documents establishing the Qualification of Bidder) & Qualification Criteria in Annexure to BDS, has been signed by all the parties.

NOW THIS UNDERTAKING WITNESSETH AS UNDER:

5 MW (AC) SPV Project	Tender No <u>SECI/C&P/PMC/11/0001/2021-22</u>	SAMPLE FORMS <u>Page 32 of 60</u>	Signature of <u>Bidder</u>
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In consideration of the above premises and agreements all the parties of this Deed of Undertaking do hereby declare and undertake:

1. In requirement of the award of the Contract by the Employer to the Joint Venture Partners, we, the Parties do hereby undertake that M/s..... the Party No.1, shall act as Lead Partner and further declare and confirm that we the parties to the Joint Venture shall jointly and severally be bound unto the Employer for the successful performance of the Contract and shall be fully responsible for the design, manufacture, supply and successful performance of the equipment in accordance with the Contract:
2. In case of any breach or default of the said Contract by any of the parties to the Joint Venture, the party(ies) do hereby undertake to be fully responsible for the successful performance of the Contract and to carry out all the obligations and responsibilities under the Contract in accordance with the requirements of the Contract.
3. Further, if the Employer suffers any loss or damage on account of any breach in the Contract or any shortfall in the performance of the equipment in meeting the performances guaranteed as per the specification in terms of the Contract, the Party(ies) of these presents undertake to promptly make good such loss or damages caused to the Employer, on its demand without any demur. It shall not be necessary or obligatory for the Employer to proceed against Lead Partner to these presents before proceeding against or dealing with the other Party(ies), the Employer can proceed against any of the parties who shall be jointly and severally liable for the performance and all other liabilities/ obligations under the Contract to the Employer.
4. The financial liability of the Parties of this Deed of Undertaking to the Employer, with respect to any of the claims rising out of the performance or non-performance of the obligations set forth in this Deed of Undertaking, read in conjunction with the relevant conditions of the Contract shall, however not be limited in any way so as to restrict or limit the liabilities or obligations of any of the Parties of this Deed of Undertaking.
5. It is expressly understood and agreed between the Parties to this Undertaking that the responsibilities and obligations of each of the Parties shall be as delineated in Appendix - I (*to be suitably appended by the Parties alongwith this Undertaking in its bid*) to this Deed of Undertaking. It is further undertaken by the parties that the above sharing of responsibilities and obligations shall not in any way be a limitation of joint and several responsibilities of the Parties under the Contract.
6. It is also understood that this Undertaking is provided for the purposes of undertaking joint and several liabilities of the partners to the Joint Venture for submission of the bid and performance of the Contract and that this Undertaking shall not be deemed to give rise to any additional liabilities or obligations, in any manner or any law, on any of the Parties to this Undertaking or on the Joint Venture, other than the express provisions of the Contract.
7. This Undertaking shall be construed and interpreted in accordance with the provisions of the Contract.
8. In case of an award of a Contract, we the parties to this Deed of Undertaking do hereby agree that we shall be jointly and severally responsible for furnishing a Contract Performance Security from a bank in favour of the Employer in the currency/ currencies of the Contract.
9. It is further agreed that this Deed of Undertaking shall be irrevocable and shall form an integral part of the bid and shall continue to be enforceable till the Employer discharges the same or upon the

5 MW (AC) SPV Project	Tender No <u>SECI/C&P/PMC/11/0001/2021-22</u>	SAMPLE FORMS <u>Page 33 of 60</u>	Signature of <u>Bidder</u>
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completion of the Contract in accordance with its provisions, whichever is earlier. It shall be effective from the date first mentioned above for all purposes and intents.

IN WITNESS, WHEREOF, the Parties to this Deed of Undertaking have through their authorised representatives executed these presents and affixed Common Seals of their companies, on the day, month and year first mentioned above.

Common Seal of
has been affixed in my/ our
presence pursuant to Board of
Director's Resolution dated

For Lead Partner (Party No.-1)
For and on behalf of M/s
.....

Name

Designation

Signature

(Signature of the authorized
representative)

WITNESS :

I.

II.

Common Seal of
has been affixed in my/our
presence pursuant to Board of
Director's Resolution dated

For Party No.-2
For and on behalf of
M/s.....

Name

(Signature of the authorized
representative)

Designation

Signature

WITNESS :

I.

II.

Common Seal of
has been affixed in my/ our
presence pursuant to Board of
Director's Resolution dated

For Party No.-3
For and on behalf of M/s.
.....

5 MW (AC) SPV Project	Tender No <u>SECI/C&P/PMC/11/0001/2021-22</u>	SAMPLE FORMS <u>Page 34 of 60</u>	Signature of <u>Bidder</u>
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Name

Designation

Signature

(Signature of the authorized
representative)

WITNESS :

I.

II.

Note:

1. For the purpose of executing the Joint Deed of Undertaking, the non-judicial stamp papers of appropriate value shall be purchased in the name of Joint Venture.
2. The Undertaking shall be signed on all the pages by the authorised representatives of each of the partners and should invariably be witnessed.

5 MW (AC) SPV Project	<u>Tender No</u> <u>SECI/C&P/PMC/11/0001/2021-22</u>	<u>SAMPLE FORMS</u> <u>Page 35 of 60</u>	<u>Signature of</u> <u>Bidder</u>
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Form F-17A**FORMAT FOR POWER OF ATTORNEY FOR JOINT VENTURE AGREEMENT**

(To be stamped in accordance with Stamp Act, the Non-Judicial Stamp Paper of Appropriate Value should be in the name of the Joint Venture)

KNOW ALL MEN BY THESE PRESENTS THAT WE, the Partners whose details are given hereunder have formed a Joint Venture under the laws of and having our Registered Office(s)/ Head Office(s) at (hereinafter called the 'Joint Venture' which expression shall unless repugnant to the context or meaning thereof, include its successors, administrators and assigns) acting through M/s being the Partner in-charge do hereby constitute, nominate and appoint M/s..... a Company incorporated under the laws of and having its Registered/ Head Office at as our duly constituted lawful Attorney (hereinafter called "Attorney" or "Authorised Representative" or "Partner In-charge") to exercise all or any of the powers for and on behalf of the Joint Venture in regard to Tender No..... Package the bids for which have been invited by Solar Energy Corporation of India Limited, 6th Floor, Plate-B, NBCC Office Block Tower-2, East Kidwai Nagar, New Delhi-110023, India (hereinafter called the 'Employer') to undertake the following acts:

- i) To submit proposal and participate in the aforesaid Bid Specification of the Employer on behalf of the "Joint Venture".
- ii) To negotiate with the Employer the terms and conditions for award of the Contract pursuant to the aforesaid Bid and to sign the Contract with the Employer for and on behalf of the "Joint Venture".
- iii) To do any other act or submit any document related to the above.
- iv) To receive, accept and execute the Contract for and on behalf of the "Joint Venture".

It is clearly understood that the Partner In-charge (Lead Partner) shall ensure performance of the Contract(s) and if one or more Partner fail to perform their respective portions of the Contract(s), the same shall be deemed to be a default by all the Partners.

It is expressly understood that this Power of Attorney shall remain valid binding and irrevocable till completion of the Defect Liability Period in terms of the Contract.

The Joint Venture hereby agrees and undertakes to ratify and confirm all the whatsoever the said Attorney/ Authorised Representatives/ Partner in-charge quotes in the bid, negotiates and signs the Contract with the Employer and/or proposes to act on behalf of the Joint Venture by virtue of this Power of Attorney and the same shall bind the Joint Venture as if done by itself.

IN WITNESS, THEREOF the Partners Constituting the Joint Venture as aforesaid have executed these presents on this day of under the Common Seal(s) of their Companies.

5 MW (AC) SPV Project	<u>Tender No</u> <u>SECI/C&P/PMC/11/0001/2021-22</u>	<u>SAMPLE FORMS</u> <u>Page 36 of 60</u>	<u>Signature of</u> <u>Bidder</u>
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for and on behalf of the
Partners of Joint Venture

.....

.....

.....

The Common Seal of the above Partners of the Joint Venture:

The Common Seal has been affixed there unto in the presence of:

WITNESS

1. Signature.....

Name

Designation

Occupation

2. Signature.....

Name

Designation

Occupation

Note:

1. For the purpose of executing the Agreement, the non-judicial stamp papers of appropriate value shall be purchased in the name of Joint Venture.
2. The Agreement shall be signed on all the pages by the authorised representatives of each of the partners and should invariably be witnessed.

5 MW (AC) SPV Project	<u>Tender No</u> <u>SECI/C&P/PMC/11/0001/2021-22</u>	<u>SAMPLE FORMS</u> <u>Page 37 of 60</u>	<u>Signature of</u> <u>Bidder</u>
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Form F-18

FORMAT FOR CONSORTIUM AGREEMENT

(To be stamped in accordance with Stamp Act, the Non-Judicial Stamp Paper of Appropriate Value should be in the name of the Consortium)

THIS JOINT DEED OF UNDERTAKING executed on this..... day of..... Two Thousand and..... by a company incorporated under the laws of and having its Registered Office at(hereinafter called the "Party No.1" which expression shall include its successors & executors) and M/s.....a company incorporated under the laws of and having its Registered Office at (hereinafter called the "Party No.2" which expression shall include its successors & executors) and M/s..... a Company incorporated under the laws of and having its Registered Office at (hereinafter called the "Party No.3" which expression shall include its successors & executors) for the purpose of making a bid and entering into a contract [hereinafter called the "Contract" {in case of award}] against the Tender No..... for (insert name of the package alongwith project name) of Solar Energy Corporation of India Limited, a Company incorporated under the Companies Act of 2013 having its registered office at 6th Floor, Plate-B, NBCC Office Block Tower-2, East Kidwai Nagar, New Delhi-110023, India (hereinafter called the "Employer").

WHEREAS the Party No.1, Party No.2 and Party No.3 have entered into an Agreement dated.....

AND WHEREAS the Employer invited bids as per the above-mentioned Specification for the design, manufacture, supply, erection, testing and commissioning including O & M of Equipment/ Materials stipulated in the Tender Documents under (insert name of the package alongwith project name)

AND WHEREAS Clause 2, Section-ITB and BDS (documents establishing the Qualification of Bidder) & Qualification Criteria in Annexure to BDS forming part of the Tender Documents, inter-alia stipulates that an Undertaking of two or more qualified manufacturers as partners, meeting the requirements of Qualification Criteria in Annexure to BDS, as applicable may bid, provided, the Consortium fulfills all other requirements under Qualification Criteria in Annexure to BDS and in such a case, the Bid Forms shall be signed by all the partners so as to legally bind all the Partners of the Consortium, who will be jointly and severally liable to perform the Contract and all obligations hereunder.

The above clause further states that this Undertaking shall be attached to the bid and the Contract Performance Security will be as per the format F-9 enclosed with the Tender Documents without any restrictions or liability for either party.

AND WHEREAS the bid is being submitted to the Employer vide proposal No..... dated by Party No.1 based on this Undertaking between all the parties; under these presents and the bid in accordance with the requirements of Clause 2, Section-ITB and BDS (documents establishing the Qualification of Bidder) & Qualification Criteria in Annexure to BDS, has been signed by all the parties.

NOW THIS UNDERTAKING WITNESSETH AS UNDER:

In consideration of the above premises and agreements all the parties of this Deed of Undertaking do hereby declare and undertake:

5 MW (AC) SPV Project	Tender No <u>SECI/C&P/PMC/11/0001/2021-22</u>	SAMPLE FORMS <u>Page 38 of 60</u>	Signature of <u>Bidder</u>
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1. In requirement of the award of the Contract by the Employer to the Consortium Partners, we, the Parties do hereby undertake that M/s..... the Party No.1, shall act as Lead Partner and further declare and confirm that we the parties to the Consortium shall jointly and severally be bound unto the Employer for the successful performance of the Contract and shall be fully responsible for the design, manufacture, supply and successful performance of the equipment in accordance with the Contract:
2. In case of any breach or default of the said Contract by any of the parties to the Consortium, the party(ies) do hereby undertake to be fully responsible for the successful performance of the Contract and to carry out all the obligations and responsibilities under the Contract in accordance with the requirements of the Contract.
3. Further, if the Employer suffers any loss or damage on account of any breach in the Contract or any shortfall in the performance of the equipment in meeting the performances guaranteed as per the specification in terms of the Contract, the Party(ies) of these presents undertake to promptly make good such loss or damages caused to the Employer, on its demand without any demur. It shall not be necessary or obligatory for the Employer to proceed against Lead Partner to these presents before proceeding against or dealing with the other Party(ies), the Employer can proceed against any of the parties who shall be jointly and severally liable for the performance and all other liabilities/ obligations under the Contract to the Employer.
4. The financial liability of the Parties of this Deed of Undertaking to the Employer, with respect to any of the claims rising out of the performance or non-performance of the obligations set forth in this Deed of Undertaking, read in conjunction with the relevant conditions of the Contract shall, however not be limited in any way so as to restrict or limit the liabilities or obligations of any of the Parties of this Deed of Undertaking.
5. It is expressly understood and agreed between the Parties to this Undertaking that the responsibilities and obligations of each of the Parties shall be as delineated in Appendix - I (*to be suitably appended by the Parties alongwith this Undertaking in its bid*) to this Deed of Undertaking. It is further undertaken by the parties that the above sharing of responsibilities and obligations shall not in any way be a limitation of joint and several responsibilities of the Parties under the Contract.
6. It is also understood that this Undertaking is provided for the purposes of undertaking joint and several liabilities of the partners to the Consortium for submission of the bid and performance of the Contract and that this Undertaking shall not be deemed to give rise to any additional liabilities or obligations, in any manner or any law, on any of the Parties to this Undertaking or on the Consortium, other than the express provisions of the Contract.
7. This Undertaking shall be construed and interpreted in accordance with the provisions of the Contract.
8. In case of an award of a Contract, we the parties to this Deed of Undertaking do hereby agree that we shall be jointly and severally responsible for furnishing a Contract Performance Security from a bank in favour of the Employer in the currency/ currencies of the Contract.
9. It is further agreed that this Deed of Undertaking shall be irrevocable and shall form an integral part of the bid and shall continue to be enforceable till the Employer discharges the same or upon the completion of the Contract in accordance with its provisions, whichever is earlier. It shall be effective from the date first mentioned above for all purposes and intents.

5 MW (AC) SPV Project	Tender No <u>SECI/C&P/PMC/11/0001/2021-22</u>	SAMPLE FORMS <u>Page 39 of 60</u>	Signature of <u>Bidder</u>
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IN WITNESS, WHEREOF, the Parties to this Deed of Undertaking have through their authorized representatives executed these presents and affixed Common Seals of their companies, on the day, month and year first mentioned above.

Common Seal of
has been affixed in my/ our
presence pursuant to Board of
Director's Resolution dated

For Lead Partner (Party No.-1)
For and on behalf of M/s
.....

Name

Designation

Signature

(Signature of the authorized
representative)

WITNESS :

I.

II.

Common Seal of
has been affixed in my/our
presence pursuant to Board of
Director's Resolution dated

For Party No.-2
For and on behalf of
M/s.....

Name

(Signature of the authorized
representative)

Designation

Signature

WITNESS :

I.

II.

Common Seal of
has been affixed in my/ our
presence pursuant to Board of
Director's Resolution dated

For Party No.-3
For and on behalf of M/s.
.....

Name

Designation

5 MW (AC) SPV Project	Tender No <u>SECI/C&P/PMC/11/0001/2021-22</u>	SAMPLE FORMS Page 40 of 60	Signature of Bidder
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Signature

(Signature of the authorized
representative)

WITNESS :

I.

II.

Note:

1. For the purpose of executing the Joint Deed of Undertaking, the non-judicial stamp papers of appropriate value shall be purchased in the name of Consortium.
2. The Undertaking shall be signed on all the pages by the authorized representatives of each of the partners and should invariably be witnessed.

Form F-18A**FORMAT FOR POWER OF ATTORNEY OF CONSORTIUM
AGREEMENT**

*(To be stamped in accordance with Stamp Act, the Non-Judicial Stamp Paper of Appropriate Value
should be in the name of the Consortium)*

KNOW ALL MEN BY THESE PRESENTS THAT WE, the Partners whose details are given hereunder have formed a Consortium under the laws of and having our Registered Office(s)/ Head Office(s) at (hereinafter called the 'Consortium' which expression shall unless repugnant to the context or meaning thereof, include its successors, administrators and assigns) acting through M/s being the Partner in-charge do hereby constitute, nominate and appoint M/s..... a Company incorporated under the laws of and having its Registered/ Head Office at as our duly constituted lawful Attorney (hereinafter called "Attorney" or "Authorized Representative" or "Partner In-charge") to exercise all or any of the powers for and on behalf of the Consortium in regard to Tender No..... Package the bids for which have been invited by Solar Energy Corporation of India Limited, 6th Floor, Plate-B, NBCC Office Block Tower-2, East Kidwai Nagar, New Delhi-110023, India (hereinafter called the 'Employer') to undertake the following acts:

- i) To submit proposal and participate in the aforesaid Bid Specification of the Employer on behalf of the "Consortium".
- ii) To negotiate with the Employer the terms and conditions for award of the Contract pursuant to the aforesaid Bid and to sign the Contract with the Employer for and on behalf of the "Consortium".
- iii) To do any other act or submit any document related to the above.
- iv) To receive, accept and execute the Contract for and on behalf of the "Consortium".

It is clearly understood that the Partner In-charge (Lead Partner) shall ensure performance of the Contract(s) and if one or more Partner fail to perform their respective portions of the Contract(s), the same shall be deemed to be a default by all the Partners.

It is expressly understood that this Power of Attorney shall remain valid binding and irrevocable till completion of the Defect Liability Period in terms of the Contract.

The Consortium hereby agrees and undertakes to ratify and confirm all the whatsoever the said Attorney/ Authorized Representatives/ Partner in-charge quotes in the bid, negotiates and signs the Contract with the Employer and/or proposes to act on behalf of the Consortium by virtue of this Power of Attorney and the same shall bind the Consortium as if done by itself.

IN WITNESS, THEREOF the Partners Constituting the Consortium as aforesaid have executed these presents on this day of under the Common Seal(s) of their Companies.

for and on behalf of the
Partners of Consortium

5 MW (AC) SPV Project	<u>Tender No</u> <u>SECI/C&P/PMC/11/0001/2021-22</u>	<u>SAMPLE FORMS</u> <u>Page 42 of 60</u>	<u>Signature of</u> <u>Bidder</u>
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.....

.....

.....

The Common Seal of the above Partners of the Consortium:

The Common Seal has been affixed there unto in the presence of:

WITNESS

1. Signature.....

Name

Designation

Occupation

2. Signature.....

Name

Designation

Occupation

Note:

1. For the purpose of executing the Agreement, the non-judicial stamp papers of appropriate value shall be purchased in the name of Consortium.
2. The Agreement shall be signed on all the pages by the authorized representatives of each of the partners and should invariably be witnessed.

5 MW (AC) SPV Project	<u>Tender No</u> <u>SECI/C&P/PMC/11/0001/2021-22</u>	<u>SAMPLE FORMS</u> <u>Page 43 of 60</u>	<u>Signature of</u> <u>Bidder</u>
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Form F-19

e-BANKING FORMAT

(To be submitted on the Letter Head of the Bidder)

1. Bidder/ Customer Name :
2. Bidder/ Customer Code :
3. Bidder/ Customer Address :
4. Bidder/ Customer E-mail ID :
5. Particulars of Bank Account
 - a) Name of Bank :
 - b) Name of Branch :
 - c) Branch Code :
 - d) Address :
 - e) Telephone Number :
 - f) Type of Account :
 - g) Account Number :
 - h) RTGS IFSC Code :
 - i) NEFT IFSC Code :
 - j) 9 digit MICR code :

I/ We hereby authorize Solar Energy Corporation of India Limited to release any amount due to me/ us in the bank account as mentioned above. I/ We hereby declare that the particulars given above are correct and complete. If the transaction is delayed or lost because of incomplete or incorrect information, we would not hold the Solar Energy Corporation of India Limited responsible.

(Signature of Vendor/ Customer)

BANK CERTIFICATE

We certify that ----- has an Account no. ----- with us and we confirm that the details given above are correct as per our records.

Bank stamp

Date

(Signature of authorized officer of bank)

5 MW (AC) SPV Project	<u>Tender No</u> <u>SECI/C&P/PMC/11/0001/2021-22</u>	<u>SAMPLE FORMS</u> <u>Page 44 of 60</u>	<u>Signature of Bidder</u>
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Form F-20**PROFORMA OF BANK GUARANTEE FOR ADVANCE
PAYMENT**

(To be stamped in accordance with Stamp Act, the Non-Judicial Stamp Paper of Appropriate Value should be in the name of the issuing Bank)

Bank Guarantee No.:
Date:

NOA/ Contract No.....

..... [Name of Contract]

To:

Solar Energy Corporation of India Limited
(A Government of India Enterprise)
6th Floor, Plate-B, NBCC Office Block Tower-2, East Kidwai Nagar, New Delhi-110023, India

Dear Sir / Madam,

We refer to the Contract ("the Contract") signed on(insert date of the Contract) between you and M/s (Name of Contractor),

(or)

vide notification of award issued on (insert date of the notification of award) by you to M/s (Name of Contractor) having its Principal place of business at (Address of Contractor) and Registered Office at (Registered address of Contractor) ("the Contractor") concerning (Indicate brief scope of work) for the complete execution of the (insert name of Package alongwith name of the Project)

Whereas, in accordance with the terms of the said Contract, the Owner has agreed to pay or cause to be paid to the Contractor an interest bearing Advance Payment against furnishing of an irrevocable bank guarantee for an amount of (Amount in figures and words) which is equal to 110% of the amount of Advance Payment.

By this letter, we, the undersigned, (insert name & address of the issuing bank), a Bank (which expression shall include its successors, administrators, executors and assigns) organized under the laws of and having its Registered/ Head Office at (insert address of registered office of the bank) do hereby irrevocably guarantee repayment of (Amount of the bank guarantee in figures and words) upon the first demand of the Employer without cavil

5 MW (AC) SPV Project	Tender No SECI/C&P/PMC/11/0001/2021-22	SAMPLE FORMS Page 45 of 60	Signature of Bidder
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or argument in the event that the Contractor fails to commence or fulfill its obligations under the terms of the said Contract for reasons whatsoever.

Provided always that the Bank's obligation shall be limited to the amount of this Bank guarantee or an amount equal to the outstanding balance of the Advance Payment and the accrued interest on the Advance Payment, taking into account such amounts, which have been repaid by the Contractor from time to time in accordance with the terms of payment of the said Contract, as certified by you.

This Guarantee shall remain in full force from the date upon which the said Advance Payment is received by the Contractor up to sixty (60) days beyond the date on which the entire Advance Payment along with the accrued interest if any due thereon has been fully adjusted in terms of the Contract i.e., up to sixty (60) days beyond the date of Completion of the Facilities under the Contract. This Guarantee may be extended from time to time, as may be desired by M/s Solar Energy Corporation of India Limited on whose behalf this Guarantee has been issued.

Any claims to be made under this Guarantee must be received by the Bank during its period of validity, i.e. upto sixty (60) days beyond the date of Completion of the Facilities by the Employer i.e. upto and inclusive of (dd/mm/yy).

Notwithstanding anything contained herein:

1. Our liability under this Bank Guarantee shall not exceed _____ (value in figures) _____ [_____ (value in words) _____].
2. This Bank Guarantee shall be valid upto _____ (validity date) _____.
3. We are liable to pay the guaranteed amount or any part thereof under this Bank Guarantee only & only if we receive a written claim or demand on or before _____ (validity date) _____.

For and on behalf of the Bank

[Signature of the authorised signatory(ies)]

Signature _____

Name _____

Designation _____

POA Number _____

Contact Number(s): Tel. _____ Mobile _____

Fax Number _____

email _____

Common Seal of the Bank _____

Witness:

Signature _____

5 MW (AC) SPV Project	Tender No <u>SECI/C&P/PMC/11/0001/2021-22</u>	SAMPLE FORMS <u>Page 46 of 60</u>	Signature of <u>Bidder</u>
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Name_____

Address_____

Contact Number(s): Tel._____ Mobile_____

email _____

Note:

1. For the purpose of executing the Bank Guarantee, the non-judicial stamp papers of appropriate value shall be purchased in the name of Bank who issues the 'Bank Guarantee'.
2. The Bank Guarantee shall be signed on all the pages by the Bank Authorities indicating their POA nos. and should invariably be witnessed.

5 MW (AC) SPV Project	<u>Tender No</u> <u>SECI/C&P/PMC/11/0001/2021-22</u>	<u>SAMPLE FORMS</u> <u>Page 47 of 60</u>	<u>Signature of</u> <u>Bidder</u>
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Form F-22

LIST OF BANKS

(For Reference Purpose)

SBI AND ASSOCIATES	OTHER PUBLIC SECTOR BANKS
1. State Bank of India	1. IDBI Bank Limited
2. State Bank of Indore	FOREIGN BANKS
	1. Bank of America NA
	2. Bank of Tokyo Mitsubishi UFJ Ltd.
	3. BNP Paribas
	4. Calyon Bank
	5. Citi Bank N.A.
NATIONALISED BANKS	6. Deutsche Bank A.G
1. Allahabad Bank	7. The HongKong and Shanghai Banking Corpn. (HSBC) Ltd.
2. Andhra Bank	8. Standard Chartered Bank
3. Bank of India	9. Societe Generale
4. Bank of Maharashtra	10. Barclays Bank
5. Canara Bank	11. Royal Bank of Scotland (RBS)
6. Central Bank of India	12. Bank of Nova Scotia
7. Corporation Bank	13. Development Bank of Singapore (DBS)
8. Dena Bank	14. Credit Agricole Corporate and Investment Bank
9. Indian Bank	SCHEDULED PRIVATE BANKS
10. Indian Overseas Bank	1. Federal Bank Limited
11. Oriental Bank of Commerce	2. Kotak Mahindra Bank Limited
12. Punjab National Bank	3. Axis Bank Limited
13. Punjab & Sind Bank	4. ICICI Bank Limited
14. Syndicate Bank	5. HDFC Bank Limited
15. Union Bank of India	6. Yes Bank Limited
16. United Bank of India	7. IDFC Bank Limited
17. UCO Bank	8. IndusInd Bank
18. Vijaya Bank	9. Karur Vysya Bank
19. Bank of Baroda	10. South Indian Bank
	11. RBL

5 MW (AC) SPV Project	Tender No SECI/C&P/PMC/11/0001/2021-22	SAMPLE FORMS Page 48 of 60	Signature of Bidder
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Form F-23

SHAREHOLDING CERTIFICATE

(To be submitted on the Letter Head of the Bidder)

Name of the Equity Holder	Type and Number of Shares Owned	% of Equity Holding	Extent of Voting Rights

Yours faithfully

(Signature and Stamp of Authorized Signatory of Bidder)

Name:

Date:

Place:

(Signature and Stamp of Company Secretary/ Director/ Chartered Accountant)

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Form F-24**POWER OF ATTORNEY FOR BIDDING COMPANY**

(To be stamped in accordance with Stamp Act, the Non-Judicial Stamp Paper of Appropriate Value should be in the name of the Bidder)

Know all men by these presents, We (name and address of the registered office of the Bidding Company as applicable) do hereby constitute, appoint and authorize Mr./Ms. (name & residential address) who is presently employed with us and holding the position of as our true and lawful attorney, to do in our name and on our behalf, all such acts, deeds and things necessary in connection with or incidental to submission of our Bid for (insert details of Tender) in response to the Tender No dated issued by Solar Energy Corporation of India Limited (SECI), New Delhi including signing and submission of the Bid and all other documents related to the Bid, including but not limited to undertakings, letters, certificates, acceptances, clarifications, guarantees or any other document which the SECI may require us to submit. The aforesaid Attorney is further authorized for making representations to the Solar Energy Corporation of India Limited, New Delhi and providing information/responses to SECI, New Delhi representing us in all matters before SECI, New Delhi and generally dealing with SECI, New Delhi in all matters in connection with Bid till the completion of the bidding process as per the terms of the above mentioned Tender.

We hereby agree to ratify all acts, deeds and things done by our said attorney pursuant to this Power of Attorney and that all acts, deeds and things done by our aforesaid attorney shall be binding on us and shall always be deemed to have been done by us.

All the terms used herein but not defined shall have the meaning ascribed to such terms under the Tender.

Signed by the within named

..... (Insert the name of the executant company)

through the hand of

Mr.

duly authorized by the Board to issue such Power of Attorney

Dated this day of

Accepted

.....
Signature of Attorney
(Name, designation and address of the Attorney)

Attested

.....
(Signature of the executant)

5 MW (AC) SPV Project	Tender No SECI/C&P/PMC/11/0001/2021-22	SAMPLE FORMS Page 50 of 60	Signature of Bidder
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(Name, designation and address of the executant)

.....
Signature and stamp of Notary of the place of execution

Common seal of has been affixed in my/ our presence pursuant to Board of
Director's Resolution dated.....

WITNESS

1.
(Signature)

Name.....

Designation

2.
(Signature)

Name.....

Designation

Notes:

The mode of execution of the power of attorney should be in accordance with the procedure, if any, laid down by the applicable law and the charter documents of the executant(s) and the same should be under common seal of the executant affixed in accordance with the applicable procedure. Further, the person whose signatures are to be provided on the power of attorney shall be duly authorized by the executant(s) in this regard.

The person authorized under this Power of Attorney, in the case of the Bidding Company/ Lead Member being a public company, or a private company which is a subsidiary of a public company, in terms of the Companies Act, 1956, with a paid-up share capital of more than Indian Rupees Five Crores, should be the Managing Director/ Whole Time Director/ Manager appointed under section 269 of the Companies Act, 1956. In all other cases the person authorized should be a director duly authorized by a board resolution duly passed by the Company.

Also, wherever required, the executant(s) should submit for verification the extract of the chartered documents and documents such as a Board resolution/ power of attorney, in favour of the person executing this power of attorney for delegation of power hereunder on behalf of the executant(s).

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Form F-25

To be executed by the successful bidder and shall form part of the Contract Agreement.

This **Non-Disclosure Agreement** ("Agreement") is made effective on this.....("Effective Date")

By and Between,

Solar Energy Corporation of India Limited, which expression includes its successors and assigns) having its Registered Office at 6th Floor, Plate-B, NBCC Office Block Tower-2, East Kidwai Nagar, New Delhi-110023, hereinafter referred as Disclosing Party / SECI.

And

.....having its registered office at which expression includes successors and assigns, hereinafter referred as Receiving Party / Contractor.

Both collectively referred to as "Parties" and individually as "Party".

WHEREAS

- A. SECI, Solar Energy Corporation of India Limited (SECI) is a CPSU under the administrative control of the Ministry of New and Renewable Energy (MNRE), set up on 20th Sept, 2011 to facilitate the implementation of JNNSM and achievement of targets set therein. It is the only CPSU dedicated to the solar energy sector. It was originally incorporated as a section-3 (not for profit) company under the Companies Act, 2013. In the present outlook of the RE sector, especially solar energy, SECI has a major role to play in the sector's development. The company is responsible for implementation of a number of schemes of MNRE for large-scale grid-connected projects under JNNSM, solar park scheme and grid-connected solar rooftop scheme along with a host of other specialised schemes. In addition, SECI is also developing its own Solar, Floating & Hybrid innovative RE Projects & is providing consultancy services to various major CPSUs for developing turnkey basis RE Projects. The company also has power trading license and is active in this domain through trading of solar power from projects set up under the schemes being implemented by it.
- B. The Contractor is engaged in
- C. SECI and Contractor are desirous of pursuing a mutually beneficial relationship through the execution of Contract awarded by SECI to the Contractor vide No.... Dated The Contractor agrees that in the course of their association for executing the said Contract Agreement, there may be sharing of confidential information between them. Through this Agreement, both parties define the obligations with respect to the confidential information.
- D. Contractor may receive from the other Party i.e. SECI certain technical, non-technical, financial, business and other proprietary and confidential information in relation to their respective businesses and contract specific tasks.
- E. Due to various Information Security related risks associated with the execution of the contract, SECI desires to mitigate the perceived risks and seeks to protect its physical and intellectual assets through defined agreements with the Contractor.

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NOW THEREFORE, in consideration of the above premises the sufficiency of which is hereby acknowledged, the Contractor agrees as follows:

1. Confidential Information

"Confidential Information" shall mean any and all information disclosed to, or otherwise acquired or identified or observed by the Receiver including its subsidiaries and affiliates, and each of their respective directors, employees, representatives and agents from the Disclosing Party and its affiliated companies, relating to the business of the Disclosing Party, or received from others that the Disclosing Party is obligated to treat as confidential, and other materials and information of a confidential nature whether communicated in writing, orally, electronically, photographically, or recorded in any other form of media, including, but not limited to, all sales and operating information, contractor's information, employee and other human resource information, existing and potential business and marketing plans and strategies, financial information, cost and pricing information, data media, know-how, designs, specifications, technical configurations, concepts, reports, methods, processes, techniques, operations, devices, , product schematics or drawings, descriptive material, patent and patent applications, trade secrets, trademarks, trade names, specifications, software (source code or object code) and the like, whether or not the foregoing information is patented, tested, reduced to practice, or subject to copyright or any other intellectual property right.

"Confidential Materials" shall mean all tangible materials containing Confidential Information, including without limitation drawings, schematics, written or printed documents, computer disks, tapes, and compact disks (CD), whether machine or user readable.

Notwithstanding the above, all Confidential Information shall be specifically marked as "CONFIDENTIAL" while disclosing the same to the Receiving Party. If the same is orally disclosed then the same to be reduced in writing and marked as "CONFIDENTIAL". Supplier, sub-contractor and other parties engaged by the Disclosing party shall have the same rights and obligations for the Confidential Information.

2. Obligations of Receiving Party relating to Information Security

Contractor agrees to conform to the following requirements:

- All intelligent electronic devices (IEDs), including devices with embedded software, Automation servers Controllers, HMIs and associated network components wherein the data is routable (equipped with Ethernet/optical Ethernet, Serial/Optical Serial) must have capabilities to exceed or meet applicable technical requirements under IEEE-1686:2013 for satisfying IEC/ISO:62443-2-3, IEC/ISO:62443-2-4 and IEC/ISO:62443-3-3 requirements.
- Contractor agrees to submit required evidences for conformance to IEC/ISO:15408 for identified network-based systems such as routers, firewalls, SIEMs etc.
- Contractor agrees to provide IT architecture details such as Firmware details, Operating System, databases, middle-ware, application frameworks and related third-party drivers, software component libraries, including usage of virtualization/container technologies, of all

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devices qualifying under clause (a) above to facilitate vulnerability analysis of the device. SECI reserves the right to undertake appropriate black-box testing of any system, sub-system to independently ascertain vulnerability of the product/solution.

- d) Contractor agrees to enable use of Indian Regional Navigational Satellite Constellation (IRNSS) based Time Synchronization signals through appropriate use of GPS technologies that support PTP (IEEE 1588) , if available commercially.

In case the same are not available commercially, Contractor may supply the GPS Clock as per their solution requirement. However, in case SECI supply the Indian Regional Navigational Satellite Constellation (IRNSS) based Time Synchronization signals through appropriate use of GPS technologies that support PTP (IEEE 1588) during this contract period (up to start of the Factory System Test), Contractor shall replace the existing Clock with the SECI supplied timing solution in the Control and Protection system, without any cost implication to SECI.

- e) Contractor commits to ensure, its adherence to secure software development life-cycle processes as per IEC/ISO:24748-1 or a similar standard and commits itself for voluntary disclosure of vulnerabilities in the system. Contractor agrees to develop and provide patches, including those of the third-party software components, for the Contractor disclosed vulnerabilities and also for the vulnerabilities discovered/ reported by any third party organization. The Contractor agrees to ensure supply and installation of patches up to the defectliability period of the system.
- f) For all software, operating system, software patches, version upgrades, firmware images etc authorized by the Contractor to be installed during the Life-Cycle of the project, the Contractor agrees to inform SECI through a digitally signed email, the **SHA-256** checksum of all software components.
- g) The Contractor agrees to provide a list of all equipment and processes where data encryption is used. All required details for Key Management shall be provided to SECI. SECI at its own cost, shall supply requisite digital certificates/keys for installation and configuration of such systems as may be required for securing its interest.
- h) SECI shall provision Notebook PCs as per recommendations of the Contractor, which shall be only authorized device from which access to the network in use by SECI, shall be permitted for any preventive maintenance, update and configuration.
- i) The Contractor agrees to sign an undertaking as per Annexure-A, for its commitment to ensure bug and malware-free software/ software patches/ embedded software/ firmware in systems such as PLC Cards/ Logic Cards/ other microprocessor based intelligent systems. The Contractor agrees to declare with each shipment, whether during initial supply stage or subsequent repairs, diagnostics or upgrades, that it shall be solely responsible for any Criminal and/ or Civil Liabilities arising from failures due to such malware/bug. The Contractor further agrees to send a digitally signed statement by email, detailing SHA-256 checksum of all firmware/software components installed during any field/factory activity.
- j) The Contractor agrees not to access through use of WiFi/ Bluetooth based networking to any device anywhere in the controlled network. All Bluetooth/ WiFi devices shall be disabled from associated firmware and Operating System in applicable devices of the controlled network.
- k) The Contractor agrees to submit details of all devices equipped with Serial Ports

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(RS232C/RS485/USB etc including with Optical interface), Virtual Serial Ports and Serial over Ethernet. Only SECI permitted devices shall be attached to serial ports. The Contractor agrees to provide systems to log details of any serial devices connected during the operation of the equipment.

3. Protection of Confidential Information

a. Use

The Receiving Party understands and acknowledges that the Confidential Information has been developed or obtained by the Disclosing Party by the investment of significant time, effort and expense, and that Confidential Information is a valuable, special and unique asset of the Disclosing Party. Therefore, the Receiving Party agrees to hold in confidence and not to disclose the Confidential Information, to any person or entity without similar obligations agreed between the Receiving Party and such person or entity. The Receiving Party will use the same standard of care it would use to secure and safeguard its own confidential information of similar importance, but in no event less than reasonable care.

b. No copying.

The Receiving Party will not copy or modify any Confidential Information without the prior written consent of the Disclosing Party, except where such copy or modification is required for the purpose of the execution of the contract. Any permitted reproduction of confidential information must contain all confidential or proprietary legends which appear on the original. The Receiving Party shall immediately notify the Disclosing Party in the event of any loss or unauthorized disclosure or use of the confidential information.

c. Permitted disclosures.

The Receiving Party shall permit access to the Disclosing Party's confidential information solely to the Receiving Party's Representatives and contractors who (i) have a need to know such information; and (ii) have signed the specified confidentiality agreement / similar contract conditions in favour of Receiving Party

All staff of Receiving Party (on-roll or outsourced) shall be bound by the terms of this Agreement. The Contractor agrees to individually authorize each of the member of staff assigned with the project, binding them individually with the terms of similar to this Agreement during and also post-employment.

d. Additional obligations.

The Receiving Party shall

- (i) notify the Disclosing Party promptly of any material unauthorized possession, use or knowledge, or attempt thereof, of the Disclosing Party's confidential information by any person or entity which may become known to the Receiving Party;
- (ii) promptly furnish to the Disclosing Party full details of the unauthorized possession, use or knowledge, or attempt thereof;

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- (iii) use reasonable efforts to assist the Disclosing Party in investigating or preventing the recurrence of any unauthorized possession, use or knowledge, or attempt thereof, of confidential information;
- (iv) use reasonable efforts to cooperate with the Disclosing Party in any litigation and / or investigation against third parties deemed necessary by the Disclosing Party to protect its proprietary rights;
- (v) promptly use all reasonable efforts to prevent a recurrence of any unauthorized possession, use or knowledge of confidential information;
- (vi) comply with the directives of authorized agencies of Government of India, through appropriate technical configurations and custom modifications to achieve compliance as sought by them from time to time; and
- (vii) extend its services as may be required, at least once annually, during the Information Security audits.

e. Unauthorized Disclosure of Information.

If it appears that the Receiving Party has disclosed (or has threatened to disclose) Confidential Information in violation of this Agreement, the Disclosing Party shall be entitled to an injunction to restrain the Receiving Party from disclosing, in whole or in part, the Confidential Information. The Disclosing Party shall not be prohibited by this provision from pursuing other remedies, subject to suitable notice of the same to Receiving Party and Receiving Party wilfully neglecting such notice or duties under the Agreement after such notice including a claim for losses and damages.

f. Exceptions

The following shall not be considered as Confidential Information:

- (a) Any information that the Receiving Party can show by documentary evidence was in its possession prior to the disclosure to it hereunder; or
 - (b) Any information that comes into the possession of the Receiving Party's Representatives, from another party who is under no obligation to the other to maintain confidentiality of such information; or
 - (c) Any information that becomes generally known other than through the fault of the Receiving Party,
 - (d) Any particular portion of the Confidential Information which was developed by Receiving Party's Representatives independently of and without reference to any Confidential Information or other information that the Disclosing Party has disclosed in confidence to any third party.
 - (e) Information available in the public domain whether in tangible or intangible form.
 - (f) Information that is not proprietary or confidential to the Disclosing Party but an information received from third party not connected to the Project.
 - (g) Information that has not been marked by the Disclosing Party as "Confidential".
- The burden of proving these exceptions to the provisions of this Agreement resides with the Receiving Party.

4. Remote Support. Remote Support shall be permitted only as per SECI ISO27001 Policy and Procedures. Further, remote support will only be permitted from within geographical boundaries of

5 MW (AC) SPV Project	<u>Tender No</u> <u>SECI/C&P/PMC/11/0001/2021-22</u>	<u>SAMPLE FORMS</u> <u>Page 56 of 60</u>	<u>Signature of</u> <u>Bidder</u>
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India. SECI reserves the right to only permit the remote support with the presence of SECI's authorized representative at the remote end.

5. Compelled Disclosure. In the event that Receiving Party or any of Receiving Party's Representatives is requested or required (by oral questions, interrogatories, requests for information or documents, subpoena, civil investigative demand or similar incidents) to disclose any of the Confidential Information to the authorities as per mandatory law, it is agreed that Receiving Party or Receiving Party's Representatives, as the case may be, will provide Disclosing Party with prompt notice of such request(s) so that Disclosing Party may seek an appropriate protective order or other appropriate remedy and/or waive compliance with the confidentiality provisions of this Agreement. In the event that such protective order or other remedy is not obtained, or Disclosing Party grants a waiver hereunder, Receiving Party or Receiving Party's Representatives may furnish that portion (and only that portion) of the Confidential Information which Receiving Party is legally compelled to disclose and will exercise reasonable efforts to obtain assurance that confidential treatment will be accorded any Confidential Information so furnished.

6. Information Security Audit. SECI reserves the right to undertake a second party / third party Information Security Audit at any point as may be required, to ascertain the risk/ vulnerability/ threats and the Contractor agrees to take necessary corrective measures in-situ or within a defined time frame, as the case may be.

7. Term and Termination

This Agreement shall be valid during the contractual period w.e.f. the date of signing of the main contract agreement.

8. Return of Confidential Information.

Upon the written request of the Disclosing Party, the Receiving Party shall return to the Disclosing Party all written materials / digital media containing the Confidential Information to the extent possible by the Receiving Party. The Receiving Party shall also deliver to the Disclosing Party written statements signed by the Receiving Party certifying that all materials have been returned within ~~five (5)~~ thirty (30) days of receipt of the request. Any unreturned Confidential Information shall be required to be maintained with similar confidentiality obligation for 10 years or as per applicable law, whichever is longer.

9. Remedies.

Receiving Party acknowledges that money damages may be incalculable and an insufficient remedy for any breach of this agreement by Receiving Party and that any such breach may cause Disclosing Party irreparable harm. Accordingly, Receiving Party also agrees that, in the event of any breach or threatened breach of this Agreement, Disclosing Party, in addition to any other remedies at law or in equity it may have, shall be entitled, without the requirement of posting a bond or other security, to equitable relief, including injunctive relief and specific performance.

10. Relationship of Parties

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Neither party has an obligation under this Agreement to purchase any service or item from the other party, or commercially offer any products using or incorporating the Confidential Information. This Agreement does not create any agency, partnership or joint venture.

11. No Grant of Proprietary Rights

The Receiving Party recognizes and agrees that, except as expressly and specifically set forth in this agreement, nothing herein shall be construed as granting any proprietary right, by license, implication, estoppel or otherwise, to any of the Disclosing Party's, confidential information, trade mark, trade name or to any invention or any patent right that has issued or that may issue based on such confidential information. All information disclosed is provided "as is" without any warranties of any kind.

12. Governing Law

This Agreement shall be governed by and interpreted in accordance with the Indian laws without regard to its conflict of law principles. In particular, the provisions of Information Technology Act 2000, and rules framed thereunder shall be applicable. Further the outline of system level requirements shall be in conformance to IS:16335-2015 standard. The applicable Information Security Policy shall be the ISO-27001:2013 policy and procedures of SECI as modified from time to time.

13. Jurisdiction and Venue.

- In connection with any litigation arising hereunder, Parties hereby
- irrevocably and unconditionally submit to the exclusive jurisdiction of courts in Delhi and
 - Further that disputes if any, shall be dealt with as per the provisions of the dispute settlement clause mentioned in the contract / General Conditions of Contract (GCC).

14. General Provisions.

- This Agreement sets forth the entire understanding of the Parties regarding confidentiality. Any amendments must be in writing and signed by both parties.
- This Agreement is intended to facilitate only the exchange of Confidential Information and is not intended to be, and shall not be construed to create a teaming agreement, joint venture association, partnership, or other business organization or agency arrangement and no Party shall have the authority to bind the other without the separate prior written agreement thereof.
- This Agreement contains the entire agreement and understanding between the Parties hereto relating to the subject matter hereof and supersedes all other prior agreements and understandings both written and oral, between the Parties with respect to the subject matter hereof. This Agreement may be executed in several counterparts, each of which will be deemed an original, and all of which taken together will constitute one single Agreement between the Parties with the same effect as if all the signatures were upon the same instrument.

IN WITNESS WHEREOF, the parties hereto have executed this Agreement at by their duly authorized representatives as of the date first set forth above.

Solar Energy Corporation of India Limited

Signature: _____

Signature: _____

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Name:

Name :

Title

Title :

Form F-26

[To be printed on the bidder's Letter Head and uploaded after signing]

UNDERTAKING REGARDING SITE CONDITON

Name of Work: : “ ”

Tender No.

1. I/We (Name of the bidder) visited the VOC PORT for the proposed 5MW Ground based Solar PV plant and the Substation locations on ----- and assessed the site condition, its surroundings and got fully understood the proposed site with reference to the terms & conditions, scope involved in the work by duly considered this information of the site survey while submitting our bid.

(Signature of authorised person of the bidder)

(Office Seal)

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Tender for Design, Engineering, Supply, Construction, Erection, Testing, Commissioning and O&M of 5 MW Grid Connected Solar PV Power Plant at VOCPT, Tuticorin



SECTION – VII

5 MW (AC) Grid Connected
Solar PV Plant at VOCPT,
Tuticorin

Tender No.
SECI/C&P/NIT/2021/VOCPT5

Section – VII
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Signature of
Bidder



Tender for Design, Engineering, Supply, Construction, Erection, Testing, Commissioning and O&M of 5 MW Grid Connected Solar PV Power Plant at VOCPT, Tuticorin



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Annexure – F	Tender Drawings
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SECTION - VII

A. SCOPE OF WORKS



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Tender for Design, Engineering, Supply, Construction, Erection, Testing, Commissioning and O&M of 5 MW Grid Connected Solar PV Power Plant at VOCPT, Tuticorin



1 Project Particulars

Particulars	Description
Design and Engineering	
AC Capacity	5 MW (AC)
Minimum DC Capacity	5.5 MWp
Cell / Module Technology	Multi-crystalline or Mono-crystalline
Origin of Supply Items	As per MNRE Order on Public Procurement (Preference to Make in India) to provide for Purchase Preference (linked with local content) in respect of RE Sector dated 9 th February, 2021 and subsequent amendments
Module Mounting Structure Type	Fixed Tilt
Design life of power plant	25 Years
O&M period	10 Years
Site Location and Land Details	
Location	VOCPT Premises
Latitude & Longitude	8°44'56.52" N, 78°10'36.50" E
Available Land Area	25 acres (approx.)
District	Tuticorin
State	Tamil Nadu
Type of Land	Government Land
Ownership	VOCPT
Design Parameters	
Basic Wind Speed (IS 875-1)	39 m/s
Seismic Zone (IS 1893-1)	Zone II
Hourly rainfall intensity for storm water drainage	92 mm/hour
Access	
Nearest Urban Area	Tuticorin
Nearest Highway	NH 138
Nearest Railway Station	Tuticorin

**5 MW (AC) Grid Connected
Solar PV Plant at VOCPT,
Tuticorin**

**Tender No.
SECI/C&P/NIT/2021/VOCPT5**

**SOW
Page 3 of 17**

**Signature of
Bidder**



Tender for Design, Engineering, Supply, Construction, Erection, Testing, Commissioning and O&M of 5 MW Grid Connected Solar PV Power Plant at VOCPT, Tuticorin



Nearest Domestic Airport	Tuticorin
Electrical Interconnection	
Interconnecting Substation	Tuticorin Auto 230/110/22 kV Substation, Muthaiapuram
Interconnection Voltage Level	22 kV
Distance to interconnecting substation	4 km (approx.)
Performance Parameters	
Performance Ratio at Plant End	78%
Capacity Utilization Factor at Substation End	20%
Other Details	
Water for Construction	To be arranged by the Contractor
Power for Construction	To be arranged by the Contractor

2 Brief Scope of Work

Scope of Supply & Work includes design & engineering, procurement & supply of equipment and materials, testing at manufacturers works, multi – level inspections, packing and forwarding, supply, receipt, unloading and storage at site, associated civil works, services, permits, licences, installation and incidentals, insurance at all stages, erection, testing and commissioning for 5 MW (AC) Grid Interactive Solar PV Power Projects, and performance demonstration with associated equipment and materials on turnkey basis along with 10 (Ten) years comprehensive operation and maintenance from the date of Operational Acceptance.

All works shall be executed as per Technical Specifications given in Section VII-B.

3 Design and Engineering

- 3.1 The Contractor shall prepare the detailed design basis report (DBR) along with relevant standards (with respective clause description), PERT Chart and MDL. The Contractor shall submit a copy to Employer for review and approval prior to detail engineering.
- 3.2 All documents and drawings shall be submitted to the Employer both in soft as well as hard copies (5 nos.) for review and approval. Every drawing shall also be submitted in '*.dwg' format. In case of design calculations done in spread sheet, editable (working) soft copy of the spread sheet shall also be submitted along with 'pdf' copies during



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every submission. The Employer shall return, as suitable, either soft or hard copies to the Contractor with category of approval marked thereon. The drawings/documents shall be approved in any one of the following categories based on nature of the comments/ type of drawing or document.

- Category-I: Approved
- Category-II: Approved subject to incorporation of comments. Re-submit for approval after incorporation of comments
- Category-III: Not approved. Re-submit for approval after incorporation of comments
- Category-IV: Kept for record/ reference
- Category-IV (R): Re-submit for record/ reference after incorporation of comments

(Note: Approval of document neither relieves the Vendor/ Contractor of his contractual obligations and responsibilities for correctness of design, drawings, dimensions, quality & specifications of materials, weights, quantities, assembly fits, systems/ performance requirement and conformity of supplies with Technical Specifications, Indian statutory laws as may be applicable, nor does it limit the Employer/ Purchaser's rights under the contract)

3.3 Submission of basic design data, design documents, drawings and engineering information including GTP and test reports to Employer or its authorized representative for review and approval in hard copy and soft copy from time to time as per project schedule. The documents typically include, but not limited to, the following:

- Solar insolation data and basis for generation
- Detailed technical specifications (GTP) of all the equipment
- General arrangement and assembly drawings of all major equipment
- Schematic diagram for entire electrical system (DC, AC and auxiliary systems)
- GTP & G.A. drawings for all types of structures/ components, 220 kV, 132 kV, 110 kV, 66 kV, 33 kV, 22 kV or 11 kV switchgears (as applicable) & other interfacing panels
- Test reports (for type, routine and acceptance tests)
- Relay setting charts
- Design calculations and sheets (licenced software as well as design templates)
- Geo technical investigation data and Topographical survey report including topographical survey data in digital format (Excel file) and Contour plan of the area.
- GA drawings of the entire project including equipment rooms/ inverter control rooms,



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office cum control room, roads, storm water drainage, sewage networks, security gate, fire protection system, perimeter fencing, transformer yard fencing etc.

- Transmission line drawings and erection plans as per DISCOM/ STU guidelines
- Quality assurance plans for manufacturing (MQP), Standard Operating procedure (SOP) and field activities (FQP)
- Detailed site EHS plan, fire safety & evacuation plan and disaster management plan.
- Detailed risk assessment and mitigation plan.
- O&M Instruction's and maintenance manuals for major equipment
- As-built drawings / documents and deviation list from good for construction (GFC)

3.4 Estimation of the plant generation based on Solar Radiation and other climatic conditions prevailing at site.

3.5 Design of associated civil, structural, electrical & mechanical auxiliary systems includes preparation of single line diagrams and installation drawings, manuals, electrical layouts, erection key diagrams, electrical and physical clearance diagrams, design calculations for Earth- mat, Bus Bar & Spacers indoor and outdoor lighting/ illumination etc., GTP and GA drawings for the major equipment including transmission line, design basis & calculation sheets, and other relevant drawings and documents required for engineering of all facilities within the periphery to be provided under this contract.

3.6 All drawings shall be fully corrected to match with the actual "As – Built" site conditions and submitted to Employer after commissioning of the project for record purpose. All as-built drawings must include the Good for Construction deviation list.

4 Procurement and Supply

The scope of procurement and supply including testing at manufacturer's works, packing, transit insurance, receipt, unloading, storage at site of equipment and materials for Grid Interactive Solar PV Power Plant with associated system shall include but not limited to the following.

- 4.1 Adequate capacity of Solar PV Modules with minimum DC capacity as mentioned in Clause 1 of Scope of Works.
- 4.2 Module Mounting Structure (MMS) with necessary hardware suitable for mounting PV Modules.
- 4.3 String Combiner Box (SCB) along with mounting structure in case of central inverter configuration.
- 4.4 Solar Cables of appropriate size and rating from PV Modules to SCB / String Inverter

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- along with straight/Y-connectors, ferrules, conduits, cable trays, cable ties and other materials required for cable laying and termination at both the ends.
- 4.5 Power Conditioning Units (Central / String Inverter) of appropriate rating.
 - 4.6 DC Cables from of appropriate size and rating from SCB to Central Inverter along with cable termination kits, ferrules / tags, conduits, cable trays, cable ties and other materials required for cable laying and termination at both the ends.
 - 4.7 AC Combiner Box / LT Switchgear panel of appropriate rating with adequate number of inputs for pooling of power from String Inverter to Inverter transformer.
 - 4.8 AC Cables (LT & HT) of appropriate size and rating along with cable termination kits, ferrules / tags, conduits, cable trays, cable ties and other materials required for cable laying and termination at both the ends.
 - 4.9 Inverter transformers of appropriate rating.
 - 4.10 22 kV Outdoor Switchgear Panels including Vacuum Circuit Breakers, Current Transformers, Voltage Transformers, Relays and other accessories for complete protection.
 - 4.11 Breakers and necessary protection arrangement at Solar Plant as per TANGEDCO norms.
 - 4.12 ABT meters with all necessary metering rated CTs and PTs at the plant take-off point as well as at the interconnecting substation as per CEA Metering Regulations 2006 as amended time to time and state metering code.
 - 4.13 22 kV Over Head Transmission Line / Under Ground Cable including Poles / Towers, Conductors, Insulators, Cable Termination Kits and associated accessories from Plant take-off point to Interconnecting Substation as per DISCOM / STU specifications / requirements including Right of Way, permits and approvals, DISCOM supervision and maintenance charges. Estimated length for the overhead transmission line is 3.2 km (approx.) and underground cable is 0.8 km (approx.). The underground cable shall also pass under an existing railway siding of SPIC chemical factory with due approvals from concerned authorities.
 - 4.14 22 kV Indoor / Outdoor Switchgear panel / bay and other associated accessories for integration of Solar PV Power Plant at the interconnecting substation as per DISCOM / STU specifications / requirements including replacement of substation equipment / materials, permits and approvals, DISCOM supervision and maintenance charges.
 - 4.15 Auxiliary supply system including auxiliary transformers, distribution panels, cables and related accessories for plant internal consumption.



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- 4.16 Uninterrupted Power Supply (UPS) including Batteries, Distribution Boards, Cables and associated equipment.
- 4.17 Battery Bank, Battery Charger, Distribution Boards, Cables and associated equipment.
- 4.18 LT Power and Control Cables including end terminations and other required accessories.
- 4.19 Communication cables including end terminations and other required accessories.
- 4.20 Supervisory Control and Data Acquisition (SCADA) for remote monitoring/control of plant facilities.
- 4.21 Data Acquisition System and communication infrastructure to transfer real time data to SLDC / RLDC as per DISCOM / STU specifications. Cost towards provision of data as Ethernet data at Jurisdiction LD centre (JLDC) end either by VSAT or any other communication shall be borne by the Contractor. For data connectivity to JLDC, the Contractor have to pay Rs. 2 Lakhs plus 18% GST to TANTRANSCO towards terminal equipment to be provided by TANTRANSCO at JLDC.
- 4.22 Speech communication to adjacent stations of TANGEDCO shall be provided either by land line or PLCC depending on the infrastructure available at VOCPT premises.
- 4.23 Earthing system including earth strip/cables, earth electrodes, earth enhancing compound and all other associated materials for complete earthing of the plant.
- 4.24 Lightning Protection System for entire plant area.
- 4.25 LED luminaries with diffuser for indoor and outdoor illumination, lighting poles, distribution boxes and power supply cables along with required conduits, fittings, etc.
- 4.26 Weather monitoring station shall include but not be limited to the following:
- Pyranometers – One in Horizontal Plane for GHI and two in inclined plane for GTI – Minimum 3 (Three) Nos.
 - Ultrasonic Anemometer (wind speed and direction) – 1 (one) no.
 - Temperature Sensor (ambient and module surface) – 3 (three) nos.
 - Power source to the all sensors wherever required
 - Data Logger
- 4.27 CCTV cameras with monitoring station along with mounting poles, power supply cables, communication cables, conduits, fittings, etc. The CCTV connectivity is to be linked with surveillance monitoring system of VOCPT Admin Building. All necessary communication cables, network switches and associated equipment for



interconnection.

- 4.28 Fire detection and fire protection system in buildings/containers, inverter / transformer yard and switchyard.
- 4.29 Testing instruments as specified.
- 4.30 Robotic type dry cleaning system with micro-fibre based brushes (if applicable).
- 4.31 Control Room equipment and furniture as required.
- 4.32 Mandatory spares as specified in Annexure – E.
- 4.33 Any other equipment / material, not mentioned but required to complete the Solar Power Plant facilities in all respect.

5 Installation, Testing and Commissioning

The scope of installation, testing and commissioning for the plant facilities shall include, but not limited, to the following.

- 5.1 Installation of PV Modules on Module Mounting Structure and interconnection of PV Modules.
- 5.2 Installation, Testing and Commissioning of String Combiner Box in case of Central Inverter configuration.
- 5.3 Installation, Testing and Commissioning of Power Conditioning Units (Central / String Inverter).
- 5.4 Laying of Solar cables through HDPE conduits with proper sealing along cable trays from PV Modules to SCB / String inverters along with termination at both the ends.
- 5.5 Installation, Testing and Commissioning of AC Combiner Box / LT Switchgear panel in case of String Inverter configuration.
- 5.6 Laying of DC cables along cable trays from SCB to Central inverter along with termination at both the ends in case of Central Inverter configuration.
- 5.7 Laying of AC LT cables along cable trays from AC Combiner Box / LT Switchgear panel to Inverter transformer along with termination at both the ends in case of String Inverter configuration.
- 5.8 Laying of AC LT cables along cable trays from Power Conditioning Unit to Inverter transformer along with termination at both the ends in case of Central Inverter configuration.
- 5.9 Installation, Testing and Commissioning of Inverter transformers.
- 5.10 Installation, Testing and Commissioning of 22 kV Switchgear panels.



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- 5.11 Installation, Testing and Commissioning of Breakers and necessary protection arrangement at Solar Plant as per TANGEDCO norms.
- 5.12 Installation, Testing and Commissioning of ABT meters with all necessary metering rated CTs and PTs at Plant take-off point as well as at Interconnecting Substation as per CEA Metering Regulations 2006 as amended time to time and state metering code.
- 5.13 Installation, Testing and Commissioning of 22 kV Over Head Transmission Line / Underground Cable from Plant take-off point to Interconnecting Substation including laying of underground cable at railway siding of SPIC chemical factory through 250 mm diameter GI pipe (top of pipe at minimum 1.0 m below rail sleeper) through horizontal directional drilling method. The cable shall be laid strictly as per the approving authority. The work should not disturb the operations of the railway line.
- 5.14 Installation, Testing and Commissioning of 22 kV Switchgear panels / bay and associated accessories for integration of Solar PV Power Plant at the interconnecting substation including rearrangement of substation equipment / materials.
- 5.15 Installation, Testing and Commissioning of auxiliary power supply system consisting of auxiliary transformers, AC distribution boards, AC LT cables and related accessories.
- 5.16 Installation, Testing and Commissioning of Uninterrupted Power Supply (UPS), Distribution boards, Cables and related accessories.
- 5.17 Installation, Testing and Commissioning of Battery Bank, Battery Charger, Distribution boards, Cables and related accessories.
- 5.18 Laying of LT Power and Control Cables along with termination at both the ends.
- 5.19 Installation, Testing and Commissioning of SCADA along with suitable communication system for interfacing PCU, Transformer, HT Panel, UPS, Fire alarm panel, WMS and other equipment with SCADA, remote monitoring capabilities and internet facility equipped with functionality as per Central Electricity Authority (Technical Standards for Connectivity to the Grid) (Amendment) Regulations, 2019.
- 5.20 Installation, Testing and Commissioning of Telemetry System for communication of Plant Data to the Transmission System Operator as per Central Electricity Authority (Technical Standards for Communication System in Power System Operations) Regulations, 2020.
- 5.21 Earthing of PV Modules, Module Mounting Structures, PCU, Switchgear panels, Transformers, and all other electrical equipment.
- 5.22 Installation of lightning protection system for entire plant facilities.
- 5.23 Installation of indoor & outdoor illumination system including all required accessories



and laying of power supply cables.

- 5.24 Installation, Testing and Commissioning of Weather Monitoring Station along with laying of required power supply and communication cables.
- 5.25 Installation of CCTV cameras on strategic locations including all required accessories, laying of power/communication cables and installation of monitoring station.
- 5.26 Installation of communication infrastructure for linking CCTV connectivity with surveillance monitoring system of VOCPT Admin Building including communication cable routing.
- 5.27 Installation of fire detection and fire protection system for buildings/containers, transformer yard and switchyard.
- 5.28 Pre-commissioning checks and tests for all equipment.
- 5.29 Synchronization and Commissioning of plant.
- 5.30 Any other works related to installation, testing and commissioning not mentioned but required to complete the Solar Power Plant facilities in all respect.

6 Civil Works

The scope of civil works for the plant facilities shall include, but not limited, to the following.

- 6.1 Conducting geotechnical investigation and topographical survey of the plant area.
- 6.2 Clearing plant site and transmission line corridor by cutting of trees, bushes and shrubs including disposal of waste material.
- 6.3 Earthwork for site grading, cutting, filling, levelling and compaction of land.
- 6.4 Construction of boundary fence (chain link fence) around the entire plant area and main gate.
- 6.5 Construction of foundation for Module Mounting Structure (MMS) and erection of MMS.
- 6.6 Construction of foundation and / or mounting structure for String Combiner Box, AC Combiner Box / LT Switchgear panel, Inverter, Inverter Transformer, Auxiliary Transformer, 22 kV Switchgear panel, Metering panel and other electrical equipment.
- 6.7 Construction of fence for transformer yard and switchyard.
- 6.8 Construction of foundation and / or mounting structure for Weather Monitoring Station and associated civil works.
- 6.9 Construction of foundation for Lighting poles, CCTV poles and other equipment.
- 6.10 Construction of foundation for 22 kV Overhead Transmission Line from Plant take-off



point to Interconnecting Substation and associated civil works.

- 6.11 Construction of foundation and / or mounting structure for 22 kV Switchgear panels / bay and associated accessories for integration of Solar PV Power Plant at the Interconnecting Substation.
- 6.12 Construction of Main Control Room (Pre-Engineered Building).
- 6.13 Construction of Security Room at the main gate.
- 6.14 Construction of water tanks, plumbing network for drinking water and cleaning of PV Modules (in case of wet-type module cleaning system).
- 6.15 Construction of approach roads, access roads, internal roads and peripheral roads, as applicable.
- 6.16 Construction of storm water drainage & sewage network including rain water harvesting mechanism.
- 6.17 Slope protection works for existing drain along the side of Gulf of Mannar and drain at bus station end.
- 6.18 Suitable arrangement of water shall be ensured to cater to day-to-day requirement of drinking water and permanent water supply for module cleaning (in case of wet-type module cleaning system) and other needs of SPV power plant during entire O&M period. As the ground water contains high concentration of chlorides, it is not suitable for construction and module cleaning purposes.
- 6.19 Any other civil works not mentioned but required to complete the Solar Power Plant facilities in all respect.

7 Statutory Approvals

7.1 Obtaining statutory approvals /clearances/ compliances on behalf of the Employer from various Government Departments, not limited to, the following:

- Pollution control board clearance, if required.
- Mining Department, if required.
- Forest Department, if required.
- All other approval as and when, as necessary for setting up of the solar power plant including CEIG/ CEA, Connectivity, Power evacuation, Railways, Port trust, etc. as per suggested guidelines.
- Open Access approvals.
- Coastal Regulation Zone approvals.

7.1.1 All statutory approvals/permissions and/or No Objection Certificates (NoC) etc. from



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DISCOM / STU for obtaining connectivity at the substation as per Project Particulars provided above.

- 7.1.2 All other statutory approvals and permissions and their respective compliances, not mentioned specifically but are required to carry out hassle free Construction and O&M of the plant.
- 7.1.3 Adequate and seamless insurance coverage during EPC and O&M period to mitigate all risks related to construction and O&M of the plant to indemnify the Employer.
- 7.2 The Contractor shall comply with the provision of all relevant acts of Central or State Governments including payment of Wages Act 1936, Minimum Wages Act 1948, Employer's Liability Act 1938, Workmen's Compensation Act 1923, Industrial Dispute Act 1947, Maturity Benefit Act 1961, Mines Act 1952, Employees State Insurance Act 1948, Contract Labour (Regulations & Abolishment) Act 1970, Electricity Act 2003, Grid Code, Metering Code, MNRE guidelines or any modification thereof or any other law relating thereto and rules made there under or amended from time to time.

8 Operation and Maintenance

- 8.1 Total Operation & Maintenance of the SPV Plant shall be with the Contractor, after operational acceptance of the plant till culmination of the O&M period and shall include deployment of engineering personnel, technicians and security personnel.
- 8.2 To provide a detailed training plan for all O&M procedures to Employer's nominated staff, which shall have prior approval from the Employer.
- 8.3 Employ and coordinate the training of contractors' personnel who will be qualified and experienced to operate and monitor the facility and to coordinate operations of the facility with the grid system.
- 8.4 Discharge obligations relating to retirement/ Superannuating benefits to employees or any other benefit accruing to them in the nature of compensation, profit in lieu / in addition to salary, etc. for the period of service with the contractor, irrespective continuance of employees with the project as employees of Contractor, after conclusion of O&M period.
- 8.5 To maintain accurate and up-to-date operating logs, records and monthly Operation & Maintenance reports at the facility. Contractor shall keep the measured daily data at regular intervals and provide the same to Employer in electronic form, compatible in CSV format. The right to use the data shall remain with the Employer.
- 8.6 The Contractor shall establish forecasting tools for submitting schedule and comply



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with respective SERC Regulations on Forecasting, Scheduling and Deviation settlement of generation. The scope under this Clause shall also include establishing and maintaining forecasting tools and appointment of QCA/Aggregator, if required. % Error (Deviation) shall be calculated as per the said regulations and DSM Charges in case of deviation beyond the permissible limits shall be borne by the Contractor.

- 8.7 Procurement of spare parts, overhaul parts, tools & tackles, equipment, consumables, etc. required for smooth operation and maintenance of the plant as per prudent/standard utility practices, OEM recommendations and warranty clauses for the entire O&M period
- 8.8 To upkeep all administrative offices, roads, tool room, stores room, equipment in clean, green and workable conditions.
- 8.9 To carry out periodic overhauls or maintenance required as per the recommendations of the original equipment manufacturer (OEM) and to furnish all such periodic maintenance schedules at the time of plant commissioning/ start of O&M contract.
- 8.10 Handover the system to maintain an inventory of spare parts, tools, equipment, consumables and supplies for the facility's operation along-with required details of recommended spares list with all associated information regarding replacement records, supplier details, tentative cost, storage details, specifications on the basis of replacement frequency and mean time between failures and mean time to restore at the culmination of penultimate year under O&M period.
- 8.11 Availability of vehicles for Employer staff during construction and O&M period as per requirement may be ensured, failing which Employer shall have full right for alternate arrangement at the risk & cost of the contractor.
- 8.12 The contractor shall be responsible for all the required activities for the successful running, committed energy generation & maintenance of the Solar Photovoltaic Power Plant covering:
- Deputation of qualified and experienced engineers and technicians at the facility.
 - Deputation of Security personnel for the complete security of plant.
 - Successful running of Solar Power Plant for committed energy generation.
 - Co-ordination with CTU/other statutory organizations as per the requirement on behalf of Employer for Joint Metering Report (JMR), furnishing generations schedules as per requirement, revising schedules as necessary and complying with grid requirements.
 - Monitoring, controlling, troubleshooting maintaining of logs & records, registers.



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- Furnishing generation data monthly to Employer/Owner by 1st week of every month for the previous month to enable Employer raise commercial bills on consumers.
- Periodic cleaning of solar modules as approved by the Employer and water quality as per the recommendations of OEM
- Replacement of Modules, Invertors/PCU's and other equipment as and when required during the O&M period without additional cost to Employer

8.13 Continuous monitoring the performance of the Solar Power Plant and regular maintenance of the whole system including Modules, PCU's, transformers, overhead line, outdoor/indoor panels/ kiosks etc. are necessary for extracting and maintaining the maximum energy output from the Solar Power Plant.

8.14 Preventive and corrective O&M of the Solar Photovoltaic Power Plant including supply of spares, consumables, wear and tear, overhauling, replacement of damaged modules, invertors, PCU's and insurance covering all risks (Fire & allied perils, earth quake, terrorists, burglary and others) as required.

8.15 The period of Operation and Maintenance will be deemed to commence from the date of completion of performance demonstration/Operational acceptance and successively the complete Solar Photovoltaic Power Plant to be handed over to the O&M contractor for operation and maintenance of the same. O&M contract shall further be extended on the mutually agreed terms and conditions for the mutually agreed period.

8.16 All the equipment required for Testing, Commissioning and O&M for the healthy operation of the Plant must be calibrated, time to time, from the NABL accredited labs and the certificate of calibration must be provided prior to its deployment.

8.17 The Contractor shall ensure that all safety measures are taken at the site to avoid accidents to his or his sub-contractor or Employer's Workmen. This will include procurement of all safety gadgets during Construction and O&M period including but not limited to, rubber mats of appropriate grade, PPE, rubber gloves and suitable shoes etc.

9 Operation and Performance Monitoring

9.1 Operation part consists of deputing necessary manpower necessary to operate the Solar Photovoltaic Power Plant at the full capacity. Operation procedures such as preparation to starting, running, routine operations with safety precautions, monitoring etc., shall be carried out as per the manufacturer's instructions to have trouble free operation of the complete system.

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- 9.2 Daily work of the operation and maintenance in the Solar Photovoltaic Power Plant involves periodic cleaning of Modules including periodic tilt angle change as and when required, logging the voltage, current, power factor, power and energy output of the Plant at different levels. The operator shall also note down time/ failures, interruption in supply and tripping of different relays, reason for such tripping, duration of such interruption etc. The other task of the operators is to check battery voltage-specific gravity and temperature. The operator shall record monthly energy output, down time, etc.
- 9.3 Earth resistance of Plant as well as individual earth pit is to be measured and recorded every month. If the earth resistance is high (compared to standards) suitable action is to be taken to bring down the same.
- 9.4 A maintenance record is to be maintained by the operator/ O&M-in-charge to record the regular maintenance work carried out as well as any breakdown maintenance along with the reasons for the breakdowns and steps taken to attend the breakdown, duration of the breakdown etc.
- 9.5 The Preventive Maintenance Schedules will 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-sunny days or evenings. Prior information shall be provided to the Employer for such preventive maintenance prior to start.
- 9.6 The Contractor will 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) in O&M period, the Contractor shall immediately report the accidents, if any, to the Employer showing the circumstances under which it happened and the extent of damage and/or injury caused.
- 9.7 The contractor shall at his own expense provide all amenities to his workmen as per applicable laws and rules.
- 9.8 If negligence / mal operation of the contractor's operator results in failure of equipment, such equipment should be repaired/replaced by the contractor free of cost.

10 Security Services

- 10.1 The contractor has to arrange proper security system including deputation of security personnel at his own cost for the check vigil for the Solar Power Plant for the complete scope of works including comprehensive O&M period.
- 10.2 The security staff may be organized to work on suitable shift system; proper checking



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& recording of all incoming & outgoing materials vehicles shall be maintained. Any occurrence of unlawful activities shall be informed to Employer immediately. A monthly report shall be sent to Employer on the security aspects.

- 10.3 Any other activities required for completion of project, but not specified in the above shall be in the scope of contractor. The Contractor must provide the BOM of the plant as per the design during the time of submission of design basis report. The detailed technical specifications of major equipment to be followed strictly and are described in the technical specification section.



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SECTION - VII

B. TECHNICAL SPECIFICATIONS

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DISCLAIMER:

1. Though adequate care has been taken while preparing the Bidding documents, the Bidders/Applicants shall satisfy themselves that the document is complete in all respects. Intimation of any discrepancy shall be given to this office immediately. If no intimation is received from any Bidder within twenty (20) days from the date of notification of NIT/ Issue of the NIT documents, it shall be considered that the NIT documents are complete in all respects has been received by the Bidder.
2. Solar Energy Corporation of India Limited (SECI), the Employer, reserves the right to modify, amend or supplement this NIT documents including all formats and Annexures.
3. While this bidding documents have been prepared in good faith, neither Employer or its authorized representatives nor their employees or advisors make any representation or warranty, express or implied, or accept any responsibility or liability, whatsoever, in respect of any statements or omissions herein, or the accuracy, completeness or reliability of information, and shall incur no liability under any law, statute, rules or regulations as to the accuracy, reliability or completeness of this bidding documents, even if any loss or damage is caused by any act or omission on their part.
4. The specifications mentioned for all the equipment which include Solar modules, PCU, combiner boxes, DC cables, module mounting structures, transformer, CT, PT, LT/ HT cables, interfacing panels, switch gears & other associated equipment etc., to complete the power generation and evacuation to the designated substation, in the present bidding documents are for the **reference** only. It is subject to revise/ alter as per the design/ planning/ good engineering practices etc., to be carried out by the selected bidder, to the satisfaction of the Employer or its authorized representatives. It is advised that the bidders must satisfy himself with the prevailing site conditions before design/ plan. The design must be optimized as per the site conditions and directed to achieve the maximum output from the installed capacity at all times. Moreover, the components not separately mentioned, but are required to complete the plant for operation is also included in the scope of bidder and shall be vetted by the Employer or its authorised representatives.

Place:

Date:

(Signature)

Name and Designation of bidder

**5 MW (AC) Grid Connected
Solar PV Plant at VOCPT,
Tuticorin**

**Tender No.
SECI/C&P/NIT/2021/VOCPT5**

**TS
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**Signature of
Bidder**



A Design Philosophy

- 1 The main objective of the design philosophy is to construct the plant with in-built Quality and appropriate redundancy to achieve high availability and reliability with minimum maintenance efforts. In order to achieve this, the following principles shall be adopted while designing the system.
 - 1.1 Adequate capacity of SPV modules, PCUs, Junction boxes etc. to ensure generation of power as per design estimates. This will be done by applying liberal de-rating factors for the array and recognizing the efficiency parameters of PCUs, transformers, conductor losses, system losses, site conditions etc.
 - 1.2 Use of equipment and systems with proven design and performance that have high availability track records under similar service conditions.
 - 1.3 Selection of the equipment and adoption of a plant layout to ensure ease of maintenance.
 - 1.4 Strict compliance with approved and proven quality assurance (QA) systems and procedures during different stages of the project, starting from sizing, selection of make, shipment, storage (at site), during erection, testing and commissioning.
 - 1.5 Proper monitoring of synchronization and recording, to ensure availability of power to the grid.
 - 1.6 The plant instrumentation and control system should be designed to ensure high availability and reliability of the plant to assist the operators in the safe and efficient operation of the plant with minimum effort.
 - 1.7 It should also provide the analysis of the historical data and help in the plant maintenance people to take up the plant and equipment on predictive maintenance.
 - 1.8 System design shall have intelligent protection mechanism which may include very fast responsive microprocessor-based relays etc., so that any disturbance from the grid will not cause any damage to the equipment of the Solar Power Plant.
- 2 The basic and detailed engineering of the plant shall aim at achieving high standards of operational performance especially considering following:
 - 2.1 SPV power plant should be designed to operate satisfactorily in synchronization with the grid within permissible limits of high voltage and frequency fluctuation conditions. It is also extremely important to safeguard the system during major disturbances, internal and external surge conditions while ensuring safe operation of the plant.
 - 2.2 The Module Mounting Structures shall be designed for such that SPV arrays produce



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- maximum energy during the period of respective tilt.
- 2.3 Shadow free plant layout to ensure minimum losses in generation during the day time.
 - 2.4 Higher system voltage and lower current options to be followed to minimise ohmic losses.
 - 2.5 Selection of PCUs with proven reliability and minimum downtime. Ready availability of requisite spares.
 - 2.6 Careful logging of operational data / historical information from the Data Monitoring Systems, and periodical analysis of the same to identify any abnormal or slowly deteriorating conditions.
 - 2.7 The designed array capacity at STC shall be suitably determined to meet the proposed guaranteed generation output at the point of interconnection by the contractor in his bid. The contractor shall take care of first year degradation also by installing additional DC capacity as the CUF calculations will not factor the first-year degradation of the modules.
 - 2.8 Each component offered by the bidder shall be of established reliability. The minimum target reliability of each equipment shall be established by the bidder considering its mean time between failures and mean time to restore, such that the availability of complete system is assured. Bidder's recommendation of the spares shall be on the basis of established reliability.
 - 2.9 Bidder shall design the plant and equipment in order to have sustained life of 25 years with minimum maintenance efforts.
 - 2.10 Enclosure of all electrical equipment installed outdoor, if applicable, shall be painted according to C5 (High) corrosive category as per ISO 12944-5.
 - 2.11 The work execution planning for supply, erection, commissioning and all other allied works for SPV Power Plant shall be such that it is completed within stipulated time from the date of order/ LOI/ NTP, whichever is later.
 - 3 The specifications provided with this bid document are functional ones; any design provided in this document is only meant as an example. The Contractor must submit a detailed design philosophy document for the project to meet the functional requirements based upon their own design in-line with the above. The bidders are advised to visit the site and satisfy themselves before bidding.



B Electrical System

1 Photovoltaic Modules

1.1 Standards and Codes

Photovoltaic Modules shall comply with the specified edition of the following standards and codes.

Standard	Description
IEC 61215-1:2016 Ed.1	Terrestrial photovoltaic (PV) modules - Design qualification and type approval - Part 1: Test requirements
IEC 61215-1-1:2016 Ed.1	Terrestrial photovoltaic (PV) modules - Design qualification and type approval - Part 1-1: Special requirements for testing of crystalline silicon photovoltaic (PV) modules
IEC 61215-1-2:2016 Ed.1	Terrestrial photovoltaic (PV) modules - Design qualification and type approval - Part 1-2: Special requirements for testing of thin-film Cadmium Telluride (CdTe) based photovoltaic (PV) modules
IEC 61730-1:2016 Ed.2	Photovoltaic (PV) module safety qualification - Part 1: Requirements for construction
IEC 61730-2:2016 Ed.2	Photovoltaic (PV) module safety qualification - Part 2: Requirements for testing
IEC 61701:2011 Ed.2	Salt mist corrosion testing of photovoltaic (PV) modules – Severity 1
IEC 62716:2013 Ed.1	Photovoltaic (PV) modules - Ammonia corrosion testing (if applicable)
IEC TS 62804-1:2015 Ed.1	Photovoltaic (PV) modules - Test methods for the detection of potential-induced degradation - Part 1: Crystalline silicon (under conditions of 85°C/85% RH for minimum 192 hours)

As per the Solar Photovoltaics, Systems, Devices and Components Goods (Requirements for Compulsory Registration) Order, 2017, PV Modules used in the grid connected solar power projects shall be registered with BIS and bear the Standard Mark as notified by the Bureau of Indian Standards.

Further, PV Modules should have been included in the ALMM list as per MNRE Approved Models and Manufacturers of Solar Photovoltaic Modules (Requirements for Compulsory Registration) Order, 2019.

1.2 Technical Requirements

Parameter	Specification
Cell/ Module Technology	Multi-crystalline or Mono-crystalline



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Module Efficiency	≥ 17% for Multi-crystalline ≥ 19% for Mono-crystalline
Rated power at STC	No negative tolerance is allowed
Temperature co-efficient of power	Not less than -0.40%/°C
Application Class as per IEC 61730	Class A

1.3 Supplier Qualification Criteria

- 1.3.1 The PV Module Supplier should have supplied minimum 5 GW capacity globally or 500 MW in India in the past 5 years (as on last date of Bid submission).
- 1.3.2 The PV Module Supplier shall be Class-I local supplier as per MNRE Order on Public Procurement (Preference to Make in India) to provide for Purchase Preference (linked with local content) in respect of Renewable Energy (RE) Sector dated 9th February, 2021 and subsequent amendments.

1.4 Component Specifications

- 1.4.1 The PV Modules glass panel shall be:
- (i) For PV Modules with backsheet, toughened low iron glass with minimum thickness of 3.2 mm for multi or mono-crystalline modules.
 - (ii) In case of glass-glass PV Modules, glass thickness shall be minimum of 2 mm on each side. It shall be laminated using a laminator with symmetrical structure, i.e., heating plates on both sides.
 - (iii) The glass used shall have transmittance of above 90%.
- 1.4.2 The back sheet used in the PV modules shall be three-layered structure with outer (air side) layer having fluoropolymer or a material with superior UV stability properties. The back sheet shall have the following properties.

Parameter	Value
Material thickness	≥ 300 micron
Water vapour transmission rate	< 2 g/m ² /day
Partial discharge test voltage	≥ 1500 V
Elongation at break	> 100%
Adhesion strength with encapsulant	> 40 N/cm
Interlayer adhesion strength	> 4 N/cm



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The Employer reserves the right to conduct Pressure Cooker (PC) test/ Highly Accelerated Stress Test (HAST) to confirm the durability of the back sheet in accelerated conditions.

- 1.4.3 The encapsulant used for the PV modules should be UV resistant and PID resistant in nature. No yellowing of the encapsulant with prolonged exposure shall occur. The encapsulant shall have the following properties.

Parameter	Value
Gel content	> 75%
Volume resistivity	> $1 \times 10^{14} \Omega \cdot \text{cm}$
Peeling strength with glass	> 40 N/cm

- 1.4.4 The sealant used for edge sealing of PV modules shall have excellent moisture ingress protection with good electrical insulation (Break down voltage >15 kV/mm) and with good adhesion strength. Edge tapes for sealing are not allowed.
- 1.4.5 The module frame shall be made of anodized Aluminium, which shall be electrically & chemically compatible with the structural material used for mounting the modules. It is required to have provision for earthing to connect it to the earthing grid. The anodization thickness shall not be less than 15 micron.
- 1.4.6 The material used for junction box shall be UV resistant to avoid degradation during module life. The degree of protection of the junction box shall be at least IP 67. Minimum three number of bypass diodes and two number of IEC 62852/EN 50521 certified MC4 compatible connectors with appropriate length of IEC 62930/EN 50618 certified 4 sq.mm copper cable shall be provided. The cable length shall be in accordance with the PV Module wiring strategy and adequate to ensure that the cable bending radius standard is not exceeded.
- 1.4.7 Each PV Module shall be provided a RFID tag which is embedded inside the module lamination and must be able to withstand harsh environmental conditions. The RFID data base shall contain the following information. RFID scanner and database of all the modules containing the following information shall also be provided.
- (i) Name of the manufacturer of PV Module
 - (ii) Name of the Manufacturer of Solar cells
 - (iii) Type of cell: Mono / Multi
 - (iv) Month and year of the manufacture (separately for solar cells and module)
 - (v) Country of origin (separately for solar cells and module)



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- (vi) I-V curve for the module
- (vii) Peak Wattage, I_m , V_m and FF for the module
- (viii) Unique Serial No. and Model No. of the module.
- (ix) Date and year of obtaining IEC PV module qualification certificate
- (x) Name of the test lab issuing IEC certificate
- (xi) Other relevant information on traceability of solar cells and modules as per ISO 9000 series.

1.5 Warranty

- 1.5.1 PV modules must be warranted with linear degradation rate of power output except for first year (maximum 3% including LID) and shall guarantee 80% of the initial rated power output at the end of 25 years.
- 1.5.2 The modules shall be warranted against all material/ manufacturing defects and workmanship for minimum of 10 years from the date of supply.
- 1.5.3 The above warranties shall be backed by third party insurance.

1.6 Approval

- 1.6.1 The Contractor shall provide Guaranteed Technical Particular (GTP) datasheet and Bill of Materials (BOM) of the module that is submitted for approval along with the datasheets of each component. The component datasheet shall contain all the information to substantiate the compliance for component specifications mentioned above.
- 1.6.2 The Contractor shall also provide test certificates corresponding to the standards mentioned above along with complete test reports for the proposed module. The tests should have been conducted at a test laboratory compliant with ISO 17025 for testing and calibration and accredited by an ILAC/IECEE member signatory. Laboratory accreditation certificate or weblink along with scope of accreditation shall also be submitted.
- 1.6.3 The BOM proposed shall be the subset of Constructional Data Form (CDF)'s of all the test reports.
- 1.6.4 The Contractor shall submit a detailed Manufacturing Quality Plan (MQP) for the PV Module with list of checks/tests performed during incoming material inspection, production, pre-dispatch and package.
- 1.6.5 The Contractor shall obtain the approval of the proposed module make & model prior to manufacturing/ inspection call.



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1.7 Manufacturing and Inspection

- 1.7.1 The Contractor shall inform the module manufacturing schedule to the Employer at least 7 (seven) working days before the start of proposed schedule.
- 1.7.2 The Employer shall perform material inspection at the Manufacturer's factory before the start of proposed manufacturing schedule. Proof of procurement of components as per the approved BOM mentioning manufacturer name, manufacturing date and relevant test certificate shall be submitted during material inspection for verification.
- 1.7.3 The Manufacturing shall start only after the clearance by the Employer after the material inspection.
- 1.7.4 The cells used for module making shall be free from all defects like edge chipping, breakages, printing defects, discoloration of top surface etc. Only Class A solar cell shall be used.
- 1.7.5 The modules shall be uniformly laminated without any lamination defects.
- 1.7.6 Current binning of modules shall be employed to limit current mismatch of modules. Different colour codes shall be provided on the modules as well as pallet for identification of different bins. Maximum three nos. of bins will be allowed for each module rating.
- 1.7.7 Pre-dispatch inspection of modules shall be performed as per the inspection protocol attached in Annexure – A.

1.8 Transportation, Handling, Storage and Installation

- 1.8.1 Transportation, handling, storage and installation of modules shall be in accordance with the manufacturer manual so as not to breach warranty conditions. The Standard Operating Procedure (SOP) for the same shall be shared by the Contractor prior to dispatch.
- 1.8.2 It is required to construct a temporary platform (graded) while keeping the modules at least above the highest flood level. If the contractor scheduled/ planned to mount the modules immediately after the receipt at site, then the module shall be kept in common storage area with proper arrangement.
- 1.8.3 Modules shall be dispatched in line with the Construction schedule. If Modules are dispatched ahead of schedule, following measures shall be undertaken:
Modules shall be covered with tarpaulin sheet. Alternatively, the Modules, properly stacked as per OEM recommendations, shall be stores under a temporary shed. Further, the temporary platform for keeping the modules shall be treated with anti-termite treatment.



2 String Combiner Box (SCB)

2.1 Standards and Codes

Standard/Code	Description
IEC 60529	Enclosure Ingress Protection
IEC 62262	Enclosure Impact Protection
IEC 60269	Fuse
IEC 61643-11	Surge Protection Device
IEC 62852 or EN 50521	Solar cable connector
IEC 60695-2-11	Fire hazard testing

2.2 Construction

- 2.2.1 SCB enclosure shall be made of UV resistant, fire retardant, thermoplastic material. Enclosure degree of protection shall be at least IP 65 and mechanical impact resistance shall be at least IK08.
- 2.2.2 Not more than two strings can be connected in parallel to a single input of SCB. One spare input terminal along with connector shall be provided for each SCB.
- 2.2.3 Every SCB input shall be provided with fuses on both positive and negative side. In case of negative grounded system, fuse at positive side only is acceptable. The rating of the fuses shall be selected such that it protects the modules from reverse current overload. The fuses shall be 'gPV' type conforming to IEC 60269-6.
- 2.2.4 DC switch disconnecter of suitable rating shall be provided at SCB output to disconnect both positive and negative side simultaneously.
- 2.2.5 Type-II surge protective device (SPD) conforming to IEC 61643-11/IEC 61643-31/EN 50539-11 shall be connected between positive/negative bus and earth.
- 2.2.6 MC4 connector conforming to IEC 62852 or EN 50521 shall be provided at each SCB input. Cable gland (double compression metallic) of suitable size for DC cables shall be provided at the SCB output.
- 2.2.7 UV resistant printed cable ferrules for solar cables and punched/ embossed aluminium tags for DC cables shall be provided at cable termination points for identification.

2.3 Warranty

The SCB unit shall be warranted against all material/ manufacturing defects and workmanship for minimum of 2 (two) years from the date of supply.

2.4 Tests

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Routine tests and acceptance tests for the assembled unit shall be as per the Quality Assurance Plan (QAP) approved by the Employer.

3 Solar and DC Cables

3.1 Standards and Codes

Cable	From	To	Conductor/ Insulation	Voltage Rating	Applicable Standard
Solar Cable*	Module	SCB	Copper/ XLPO	1.5 kV DC	IEC 62930 / EN 50618
DC Cable	SCB	PCU	Copper or Aluminium/ XLPE	1.5 kV DC	IS 7098 Part II

* Cable used for module interconnection shall also be referred as solar cable.

- 3.2 Solar cable outer sheath shall be flame retardant, UV resistant and black in colour. Solar cable with positive polarity should have marking of red line on black outer sheath.
- 3.3 DC cables shall be single core, armoured, Flame Retardant Low smoke (FRLS), PVC outer sheath conforming to IS 7098-II. DC cable with positive polarity should have marking of red line on black outer sheath.
- 3.4 In addition to manufacturer's identification on cables as per relevant standard, following marking shall also be provided over outer sheath.
- (i) Cable size and voltage grade
 - (ii) Word 'FRNC/ FRLS' (as applicable) at every metre
 - (iii) Sequential marking of length of the cable in metres at every metre
- 3.5 Cables shall be sized based on the following considerations:
- (i) Rated current of module
 - (ii) In case of central inverters, average voltage drop in the cables (from PV Modules to PCU) shall be limited to 1.5 % of the rated voltage. In case of string Inverters, average voltage drop (from PV module to string inverter) shall be limited to 0.5% of the rated voltage drop. The Contractor shall provide voltage drop calculations in excel sheet.
 - (iii) Short circuit withstand capability
 - (iv) De-rating factors according to laying pattern
- 3.6 Warranty

The cables (Solar and DC) shall be warranted against all material/ manufacturing defects and workmanship for minimum of 1 (one) year from the date of supply.



3.7 Tests

Type test, routine test and acceptance tests requirements shall be as per IEC 62930/EN 50618 for solar cables and IS 7098-II for DC cables.

3.8 Installation

3.8.1 Cable installation shall be as per IS 1255.

3.8.2 Only terminal cable joints shall be accepted. No cable joint to join two cable ends shall be accepted.

3.8.3 Solar cables shall be provided with UV resistant printed ferrules and DC cables shall be provided with punched/ embossed aluminium tags. The marking shall be done with good quality letter and numbers of proper size so that the cables can be identified easily.

3.8.4 Cable terminations shall be made with properly crimped lugs and passed through cable glands at the entry & exit point of the cubicles. Bimetallic lugs shall be used for connecting Cu bus bar and Al cables or vice-versa.

3.8.5 Solar cables, wherever exposed to direct sunlight, shall be laid through Double Wall Corrugated (DWC) HDPE conduits. The size of the conduit or pipe shall be selected on the basis of 40% fill criteria.

3.8.6 Solar cables shall be aesthetically tied to Module Mounting Structure using UV resistant cable-ties suitable for outdoor application.

3.8.7 All cables shall be laid along overground cable trays with cable cleats/ties ensuring minimum clearance of 500 mm above FGL.

3.8.8 Cable Trays

3.8.8.1 Cable trays shall be horizontal ladder/perforated type complete with matching fittings (like brackets, elbows, bends, reducers, tees, crosses, etc.), accessories (like side coupler plates, etc. and hardware (like bolts, nuts, washers, G.I. strap, hook etc.) as required.

3.8.8.2 Cable trays, fittings and accessories shall be fabricated out of rolled mild steel sheets free from flaws such as laminations, rolling marks, pitting etc. and shall be hot dip galvanized as per relevant IS codes.

3.8.8.3 Cable trays shall have standard width of 150 mm, 300 mm & 600 mm and standard lengths of 2.5 metre. Thickness of mild steel sheets used for fabrication of cable trays and fittings shall be minimum 2 mm. The thickness of side coupler plates shall be minimum 3 mm.

3.8.8.4 Cable troughs shall be required for branching out few cables from main cable route.



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These shall be U-shaped, fabricated of mild steel sheets of thickness 2 mm and shall be hot dip galvanized as per relevant IS codes. Troughs shall be standard width of 50 mm & 75 mm with depth of 25 mm.

4 Power Conditioning Unit

4.1 Standards and Codes

Power Conditioning Unit (PCU) shall comply with the specified edition of the following standards and codes.

Standard	Description
IEC 61683 Ed. 1	Photovoltaic systems – Power conditioners – Procedure for measuring efficiency
IEC 62109-1 Ed. 1	Safety of power converters for use in photovoltaic power systems – Part 1: General requirements
IEC 62109-2 Ed. 1	Safety of power converters for use in photovoltaic power systems – Part 2: Particular requirements for inverters
IEC 61000-6-2 Ed. 2	Electromagnetic compatibility (EMC) – Part 6-2: Generic standards – Immunity standard for industrial environments
IEC 61000-6-4 Ed. 2.1	Electromagnetic compatibility (EMC) – Part 6-4: Generic standards – Emission standard for industrial environments
IEC 62116 Ed. 2	Utility-interconnected photovoltaic inverters – Test procedure of islanding prevention measures
IEC 60068-2-1:2007	Environmental testing – Part 2-1: Tests – Test A: Cold
IEC 60068-2-2:2007	Environmental testing – Part 2-2: Tests – Test B: Dry heat
IEC 60068-2-14:2009	Environmental testing – Part 2-14: Tests – Test N: Change of temperature
IEC 60068-2-30:2005	Environmental testing – Part 2-30: Tests – Test Db: Damp heat, cyclic (12 h + 12 h cycle)
CEA Technical Standards for Connectivity to the Grid Regulations 2007 with 2013 and 2019 Amendment	
As per the Solar Photovoltaics, Systems, Devices and Components Goods (Requirements for Compulsory Registration) Order, 2017, Inverters used in the grid connected solar power projects shall be registered with BIS and bear the Standard Mark as notified by the Bureau of Indian Standards.	

4.2 Supplier Qualification Criteria

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- 4.2.1 The Inverter Supplier should have supplied minimum 5 GW capacity globally or 500 MW in India in the past 5 years (as on last date of the bid submission).
- 4.2.2 The Inverter Supplier shall be Class-I local supplier as per MNRE Order on Public Procurement (Preference to Make in India) to provide for Purchase Preference (linked with local content) in respect of Renewable Energy (RE) Sector dated 9th February, 2021 and subsequent amendments.

4.3 Technical Requirements

Parameter	Specification
Rated AC power	As per design
Maximum input voltage	1500 V
Rated AC output voltage	As per design
Tolerance on rated AC output voltage	+/-10%
Rated frequency	50 Hz
Operating frequency range	47.5 Hz to 52 Hz
Power factor control range	0.9 lag to 0.9 lead
European efficiency	Minimum 98%
Maximum loss in Sleep Mode	0.05% of rated AC power
Total Harmonic Distortion	Less than 3% at 100% load
Degree of protection	Central Inverter – IP 20 (Indoor) / IP 55 (Outdoor), String Inverter – IP 65

- 4.3.1 The rated/ name plate AC capacity of the PCU shall be AC power output of the PCU at 50°C.
- 4.3.2 Maximum power point tracker (MPPT) shall be integrated in the PCU to maximize energy drawn from the Solar PV array. The MPPT voltage window shall be sufficient enough to accommodate the output voltage of the PV array at extreme temperatures prevailing at site.
- 4.3.3 The PCU output shall always follow the grid in terms of voltage and frequency. The operating voltage and frequency range of the PCU shall be sufficient enough to accommodate the allowable grid voltage and frequency variations.

4.4 Construction

- 4.4.1 Power Conditioning Unit (PCU) shall consist of an electronic three phase inverter along with associated control, protection, filtering, measurement and data logging devices.



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- 4.4.2 Every DC input terminal of PCU shall be provided with fuse / MCB / MCCB of appropriate rating. The combined DC feeder shall have suitably rated isolators for safe start up and shut down of the system. One spare DC input terminal shall be provided for each PCU. String inverters without DC fuse may be acceptable in case not more than two strings are connected to the same MPPT.
- 4.4.3 Type-II surge protective device (SPD) conforming to IEC 61643-11 / IEC 61643-31 / EN 50539-11 shall be connected between positive/ negative bus and earth.
- 4.4.4 In case external auxiliary power supply is required, UPS shall be used to meet auxiliary power requirement of PCU. It shall have a backup storage capacity of 2 hours.
- 4.4.5 Circuit Breaker or Relay of appropriate voltage and current rating shall be provided at the output to isolate the PCU from grid in case of faults.
- 4.4.6 The PCU shall be tropicalized and the design shall be compatible with conditions prevailing at site. Suitable number of exhaust fan with proper ducting shall be provided for cooling keeping in mind the extreme climatic condition of the site as per the recommendations of OEM to achieve desired performance and life expectancy.
- 4.4.7 All the conducting parts of the PCU that are not intended to carry current shall be bonded together and connected to dedicated earth pits through protective conductor of appropriate size. DC negative terminal shall be grounded. In case DC negative grounding is not possible, appropriate anti-PID device shall be provided.
- 4.4.8 Dedicated communication interface shall be provided to monitor the PCU from SCADA.
- 4.4.9 PCU front panel shall be provided with LCD/ LED to display all the relevant parameters related to PCU operation and fault conditions. It shall include, but not limited to, the following parameters.
- (i) DC input power
 - (ii) DC input voltage
 - (iii) DC input current (for each terminal)
 - (iv) AC output power
 - (v) AC output voltage (all the 3 phases and line)
 - (vi) AC output current (all the 3 phases and line)
 - (vii) Frequency
 - (viii) Power Factor



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In case of outdoor PCU, PCU without LCD display with provision for Data access over Bluetooth / WiFi shall be acceptable.

- 4.4.10 String inverter, if installed in open, shall be placed inside a canopy shed with at least 15 cm in all directions. Alternatively, the Contractor may install the inverter on the column post of the Module Mounting Structure, below the modules. In such case, the canopy is not required, and the column and foundation shall be designed accordingly.
- 4.4.11 AC combiner box for string inverter configuration shall comply with Clause 9 of the Technical Specifications with exception of the following.
- (i) Rated System Voltage – Inverter output voltage
 - (ii) IP Rating – IP 55
 - (iii) Metering System – Not required
 - (iv) CBCT – Not applicable

4.5 Operating Modes

Operating modes of PCU shall include, but not limited to, the following modes. These operating modes and conditions for transition are indicative only. The Contractor shall provide the detailed flow chart indicating the various operating modes and conditions for transition during detailed engineering.

4.5.1 Standby Mode

The PCU shall continuously monitor the input DC voltage and remain on Standby Mode until it reaches the pre-set value.

4.5.2 MPPT Mode

When the input DC voltage is above the pre-set value and AC grid connection conditions are fulfilled, the PCU shall enter into MPPT mode.

4.5.3 Sleep Mode

When the AC output power/DC input voltage decreases below the pre-set value for pre-set time delay, the PCU shall switch into Sleep Mode.

4.6 Protection Features

The PCU shall include appropriate self-protective and self-diagnostic feature to protect itself and the PV array from damage in the event of PCU component failure or from parameters beyond the PCU's safe operating range due to internal or external causes. The self-protective features shall not allow signals from the PCU front panel to cause the PCU to be operated in a manner which may be unsafe or damaging. Faults due to



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malfunctioning within the PCU, including commutation failure, shall be cleared by the PCU protective devices.

The PCU shall provide protection against the following type of faults, among others.

- (i) DC/AC over current
- (ii) DC/AC over voltage
- (iii) DC reverse polarity
- (iv) DC earth fault
- (v) AC under voltage
- (vi) AC under frequency/over frequency
- (vii) Islanding
- (viii) Over temperature
- (ix) Lightning surges

4.7 Grid Support Functions

4.7.1 Active power regulation

The PCU shall be able to limit the active power exported to the grid based on the set point provided through PCU front control panel. The PCU shall also be able to automatically limit the active power after an increase in grid frequency above a pre-set value. The ramp rate shall be adjustable during operation and start-up after fault. The applicability of the requirement shall be as per CEA regulation and compliance.

4.7.2 Reactive power control

The PCU shall be able to inject /absorb reactive power to/ from the grid based on the set point provided through PCU front control panel. The same shall be performed automatically with adjustable ramp rate based on dynamic changes in grid voltage or reactive power reference.

4.7.3 Voltage Ride Through

The PCU shall remain connected to the grid during temporary dip or rise in grid voltage as per the LVRT and HVRT requirements of CEA Technical Standards for Connectivity to the Grid Regulations. The PCU shall also be able to inject reactive power during the period of voltage dip.

4.8 Warranty

The complete Power Conditioning Unit shall be warranted against all material/



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manufacturing defects and workmanship for minimum of 5 (five) years from the date of supply.

4.9 Tests

4.9.1 Type Tests

The type test certificates as per the standards mentioned above should be from any of the ILAC/IECEE member signatory accredited test centres. Laboratory accreditation certificate or weblink along with scope of accreditation shall also be submitted. It is the responsibility of the Contractor to substantiate the compliance for CEA Regulations using test reports.

4.9.2 Routine Tests

Routine tests and acceptance tests shall be as per the Quality Assurance Plan (QAP) approved by the Employer.

5 **Inverter Transformer and Auxiliary Transformer**

5.1 Standards and Codes

Inverter transformer and auxiliary transformer, wherever applicable, shall comply with the latest edition of the following standards and codes including amendments.

Standard	Description
IS 2026, IEC 60076	Specification of Power Transformers
IS 11171, IEC 60076	Dry-Type Power Transformers
IS 2099, IEC 60137	Bushings for alternate voltage above 1000 V
IS 335, IEC 60296	Insulating oil
IS 3639	Fittings and Accessories for Power Transformers
IS 12063	Degree of protection provided by enclosures
CBIP publication no. 295	
Indian Electricity rules and other statutory regulations	

5.2 Technical Requirements

Parameters	Inverter Transformer	Auxiliary Transformer
VA Rating	2 x 2.5 MVA	As per system design
Voltage Ratio	22 kV / Inverter output voltage	As per system design



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Duty, Service & Application	Continuous Solar Inverter application and converter duty (Outdoor)	Continuous application (Outdoor/Indoor)
Winding	As per system design requirement	2
Frequency	50 Hz	50Hz
Nos. of Phase	3	3
Vector Group & Neutral earthing	As per system/inverter manufacturer requirement	Dyn11
Cooling	ONAN	ONAN / AN
Tap Changer	OCTC, No. of steps shall be as per system requirement	
Impedance at 75°C	As per Inverter Manufacturer requirement	As per system requirement
Permissible Temperature rise over an ambient of 50°C (irrespective of tap)		
Top Oil	50°C	As per IS/IEC
Winding	55°C	As per IS/IEC
SC withstand time (thermal)	2 second	2 second
Short Circuit Apparent power	As per system requirement	
Termination	As per system requirement	
Bushing rating, Insulation class (Winding & bushing)	24 kV – porcelain bushings 1.1 kV – epoxy bushings	As per the system requirement
Noise level	As per NEMA TR-1	
Loading Capability	Continuous operation at rated MVA on any tap with voltage variation of +/-3%, also transformer shall be capable of being loaded in accordance with IEC 60076-7	
Flux density	Not to exceed 1.9 Wb/sq.m. at any tap position with combined frequency and voltage variation from rated V/f ratio by 10% corresponding to the tap. Transformer shall also withstand following over fluxing conditions due to combined voltage and frequency fluctuations: a) 110% for continuous rating b) 125% for at least one minute c) 140% for at least five seconds. Bidder shall furnish over fluxing characteristic up to 150%	
Air Clearance	As per CBIP	

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**Signature of
Bidder**



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5.3 Construction

- 5.3.1 The transformer shall be provided with conventional single compartment conservator with prismatic toughened glass oil gauge. The top of the conservator shall be connected to the atmosphere through indicating type cobalt free silica gel breather with transparent enclosure. Silica gel shall be isolated from atmosphere by an oil seal. Inverter transformers shall be provided with Magnetic Oil Gauge (MOG) with low oil level alarm contact.
- 5.3.2 It is the responsibility of the Contractor to ensure that the inverter transformer comply with all the requirements of inverter provided by the inverter manufacturer.
- 5.3.3 Inverter Transformer shall be designed for at least 5% total harmonic distortion (THD) to withstand distortion generated by the inverter as well as possible outside harmonics from the network.
- 5.3.4 The transformer shall be suitable for continuous operation with a frequency variation of $\pm 2.5\%$ from nominal frequency of 50 Hz without exceeding the specified temperature rise.
- 5.3.5 Inverter Transformer shall have shield winding between LV & HV windings. Each LV winding must be capable of handling non-sinusoidal voltage with voltage gradient as specified by the inverter manufacturer. Also, shield winding shall be taken out from tank through shield bushing and the same shall be brought down to the bottom of the tank using copper flat and support insulator for independent grounding.
- 5.3.6 Neutral bushing of Inverter duty transformer shall be brought outside the tank for the testing purpose. It shall be covered with MS sheet and a sticker "For testing purpose only. Do not earth". Neutral bushing of auxiliary transformer shall be brought outside the tank for earthing.
- 5.3.7 Transformer shall have 150 mm dial type Oil Temperature Indicator (OTI) and Winding Temperature Indicator (WTI) with alarm and trip contacts. All indicators shall have accuracy of 1.5%. For inverter transformers, WTI shall be provided for all the windings.
- 5.3.8 The radiators shall be detachable type, mounted on the tank with shut off valve at each point of connection to the tank, lifts, along with drain plug/ valve at the bottom and air release plug at the top.
- 5.3.9 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. Marshalling Box of all transformers shall be preferably Tank Mounted. One



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dummy terminal block in between each trip wire terminal shall be provided. At least 10% spare terminals shall be provided on each panel. The gasket used shall be of neoprene rubber. 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.

- 5.3.10 Buchholz relay, double float type with alarm and trip contacts, along with suitable gas collecting arrangement shall be provided.
- 5.3.11 Inverter transformer shall be provided with spring operated Pressure Relief Device (with trip contacts) with suitable discharge arrangement for oil. For Auxiliary transformers, diaphragm type explosion vent shall be provided.
- 5.3.12 Filter valve at top the tank and drain cum sampling valve at bottom of the tank shall be provided.
- 5.3.13 All external surface of the transformer shall be painted with colour shade RAL 7032. The painting shall be according to C5 (High) corrosive category as per ISO 12944-5. Internal surface of cable boxes and marshalling box shall be painted with epoxy enamel white paint. The minimum dry film thickness (DFT) shall be 100 microns.
- 5.3.14 LV and HV cable box shall be provided with disconnecting chamber to facilitate the movement of transformer without disturbing cable box and termination.
- 5.3.15 Air release plug, bi-directional wheel/skids, cover lifting eyes, transformer lifting lugs, jacking pads, towing holes, core and winding lifting lugs, inspection cover, rating plate, valve schedule plate, accessories and terminal marking plates, two nos. of earthing terminals shall be provided.
- 5.3.16 Rain hoods to be provided on Buchholz, MOG & PRD. Entry points of wires shall be suitably sealed.
- 5.3.17 The accessories listed above are indicative only. Accessories which are not mentioned above but required for satisfactory operation of the transformers are deemed to be included in the contract without extra charges.
- 5.3.18 Fire-protection for inverter transformer shall be provided in accordance with relevant CEA regulations as amended time to time.

5.4 Dry Type Auxiliary Transformer

- 5.4.1 Transformer shall be cast resin encapsulated dry type transformer, made of cold rolled grain-oriented silicon steel laminations of M4 grade or better. Winding conductor shall be electrolytic grade Copper/Aluminium and insulation shall be Class F or better.



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5.4.2 The transformers shall be housed in a metal protective housing, having a degree of protection of IP 23 suitable for indoor installation. The enclosure shall be provided with suitable hardware and accessories required for satisfactory operation of the transformer per the relevant standard.

5.5 Warranty

The transformer shall be warranted against all material/ manufacturing defects and workmanship for minimum of 5 (five) years from the date of supply.

5.6 Testing and Inspection

5.6.1 Type Tests and Special Tests

The following type test and special test reports shall be submitted during detailed engineering. The tests should have been conducted on the similar transformer by NABL accredited laboratory.

5.6.1.1 Type Tests

- (i) Lightning impulse (Full & Chopped Wave) test on windings as per IS 2026-3 / IEC 60076-3
- (ii) Temperature Rise test at a tap corresponding to maximum losses as per IS 2026-2 / IEC 60076-2

5.6.1.2 Special Tests

- (i) Measurement of zero-sequence impedance as per IS 2026-1 / IEC 60076-1
- (ii) Measurement of harmonics of no-load current as per IS 2026-1 / IEC 60076-1
- (iii) Measurement of acoustic noise level as per NEMA TR-1
- (iv) Short-circuit withstand test as per IS 2026-5 / IEC 60076-5

In case the contractor is not able to submit the test reports during detailed engineering, the contractor shall submit the reports of type/special tests either conducted by NABL accredited laboratory or witnessed by Employer.

5.6.1.3 Type and Special tests are not required for auxiliary transformers of rating including 100 kVA and below. However, auxiliary transformer shall have minimum 3-star BEE rating as per BIS guidelines.

5.6.2 Routine Tests

Each completed transformer shall be subjected to following routine tests as per the latest edition of IEC 60076 unless specified otherwise.

- (i) Measurement of winding resistance at each tap



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- (ii) Measurement of voltage ratio between HV and LV windings at each tap
- (iii) Check of vector group
- (iv) Measurement of no-load loss and no-load current
- (v) Measurement of short-circuit impedance and load loss
- (vi) Magnetic balance test as per CBIP manual publication no. 295
- (vii) Separate source voltage withstand test
- (viii) Induced over voltage withstand test
- (ix) Measurement of insulation resistance
- (x) Marshalling box functional test
- (xi) IR Measurement on wiring of marshalling box
- (xii) Breakdown voltage test on transformer oil as per IS 335
- (xiii) Oil leakage test on completely assembled transformer along with radiators

5.6.3 Tests at Site

After erection at site all transformer(s) shall be subjected to the following tests.

- (i) Measurement of voltage ratio
- (ii) Check of vector group
- (iii) Magnetic balance test
- (iv) Measurement of insulation resistance
- (v) Breakdown voltage test on transformer oil

In case the equipment is not found as per the requirements of the Technical Specifications of NIT, all expenses incurred during site testing will be to the Contractor's account and the equipment shall be replaced by him at free of cost.

6 HT Switchgear

6.1 Standards and Codes

All equipment provided under HT switchgear shall comply with latest editions and amendments of the relevant IEC standards and IS codes. In particular, the switchgear shall comply with the following standards and codes.

Standard/Code	Description
IS/IEC 62271-1	High Voltage Switchgear and Control gear – Part 1: Common Specifications
IS/IEC 62271-100	High Voltage Switchgear and Control gear – Part 100: AC Circuit Breakers



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IS/IEC 62271-102	High Voltage Switchgear and Control gear – Part 102: AC Disconnectors and Earthing Switches
IS/IEC 62271-200	High Voltage Switchgear and Control gear – Part 200: AC Metal Enclosed Switchgear and Control gear for Rated Voltages Above 1 kV and Up to and Including 52 kV
IEC 61869	Instrument Transformers
IS 3231	Electrical relays for power systems protection
IEC 60255	Measuring relays and protection equipment
IEC 61850	Communication networks and systems for power utility automation
IEC 61131-3	Programmable controllers – Part 3: Programming languages
IS 9385	High voltage fuses
IS 9431	Indoor post insulators of organic material for systems with nominal voltages greater than 1000 V up to and including 300 kV
IEC 60099-4	Surge arresters – Part 4: Metal-oxide surge arresters without gaps for A.C. systems
IS 3070-3	Lightning Arresters for Alternating Current Systems – Part 3: Metal Oxide Lightning Arresters Without Gaps
IEC 62052-11	Electricity metering equipment (A.C.) – General requirements, tests and test conditions – Part 11: Metering equipment
IEC 62053	Electricity metering equipment (A.C.) – Particular requirements
IS 14697	AC Static Transformer Operated Watthour and Var-hour Meters, Class 0.2S and 0.5S

6.2 Technical Parameters

Parameter	Specification
System Parameters	
Highest system voltage	24 kV
Rated system voltage	22 kV
Rated frequency	50 Hz
Number of phases	3
Power frequency withstand voltage	50 kV (r.m.s.)
Lightning impulse withstand voltage	125 kV (peak)
System fault current	As per system requirement



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Internal Arc Classification Rating	IAC-A, FLR, System Fault Current for 1 s
Circuit Breaker	
Type	Vacuum type
Operating duty cycle	O – 3 min – CO – 3 min – CO
Short circuit breaking current	As per system requirement
Short circuit making current	2.5 times S.C. breaking current
Re-strike performance class	C1
Mechanical endurance class	M1
Current Transformer	
Accuracy class	0.2 for metering (0.2S for metering at outgoing feeder), 5P20 for protection
Rated VA burden	As per requirement
Insulation class	Class E or better
Voltage Transformer	
Accuracy class	0.2 for metering, 3P for protection
Rated VA burden	As per requirement
Insulation class	Class E or better

6.3 Switchgear Panel

- 6.3.1 The switchgear panel shall be free standing, floor mounted, single front, single tier fully compartmentalized, metal enclosed construction. Each panel shall have separate compartments for circuit breaker, bus bars, cable termination and auxiliary circuit.
- 6.3.2 The circuit breakers shall be mounted on horizontally withdrawable trucks with locking facility in SERVICE and TEST positions.
- 6.3.3 The panel enclosure shall be constructed with CRCA steel/Aluzinc sheet. The thickness of load bearing members shall be minimum 3 mm and that of non-load bearing members shall be minimum 2 mm.
- 6.3.4 All surfaces shall be painted with colour shade RAL 7032. The painting shall be according to C5 (High) corrosive category as per ISO 12944-5.
- 6.3.5 The circuit breaker and auxiliary circuit compartments provided on the front side shall have separate concealed hinged doors. Cable and bus bar compartments provided on the rear side shall have separate bolted covers. All doors and covers shall be



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- provided with neoprene/synthetic rubber gaskets to prevent entry of vermin and dust.
- 6.3.6 Pressure relief device shall be provided in each high voltage compartment of a panel to safely vent the gases in the event of internal arc. Seal-off bushing arrangement shall be provided between the breaker compartment and bus bar/cable compartments to prevent transfer of arc from one compartment to other.
- 6.3.7 Automatic safety shutters shall be provided to cover up the fixed high voltage contacts on bus bar and cable sides when the truck is moved to TEST position.
- 6.3.8 Degree of protection shall not be less than IP 5X for auxiliary circuit compartment. However, for remaining compartments it shall not be less than IP 4X. For outdoor panels, degree of protection shall not be less than IP 55.
- 6.3.9 Mechanical /Electrical interlocks shall be provided to prevent mal-operation and in particular to ensure the following.
- (i) The breaker shall be operated only if it is in SERVICE or TEST position.
 - (ii) Movement of the breaker truck between SERVICE and TEST positions shall be possible only if the breaker is OFF.
 - (iii) It shall be possible to open the door only when the breaker is in TEST position.
- 6.3.10 Panel shall be provided with local bus-bar protection
- 6.3.11 Each switchgear panel shall be provided with thermostatically controlled space heaters, separately for breaker, cable and bus bar compartments, to prevent condensation within the compartment. The space heater shall be connected to 240 V, 50 Hz, single phase AC supply through suitable switch and fuse.
- 6.3.12 240 V, 5 A, SPN industrial socket-outlet with ON/OFF switch shall be provided in each panel.
- 6.3.13 Each panel shall be provided with LED lamp rated for 240 V, 50 Hz, single phase AC supply for interior illumination controlled by door switch.
- 6.3.14 Gapless, metal-oxide surge arrestors shall be provided between line and earth in cable compartment of the switchgear panel.
- 6.3.15 Suitable lifting hooks shall be provided for each panel.
- 6.4 Circuit Breakers
- 6.4.1 Circuit breakers shall be of vacuum type. It shall comprise of three separate identical single pole units operated through the common shaft and shall be fully interchangeable both electrically and mechanically.
- 6.4.2 The circuit breaker operating mechanism shall be based on motor operated spring charging and it shall be re-strike free, trip free both electrically and mechanically, with



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anti-pumping feature.

- 6.4.3 The rated control voltage of the spring charging motor shall be 110 VDC/230 VAC. Closing coil shall operate at all values of voltages between 85% and 110% of rated voltage. Opening coil shall operate correctly under all operating conditions of the circuit breaker up to the rated breaking capacity and at all values of supply voltage between 70% and 110% of rated voltage.
- 6.4.4 The spring charging motor shall have adequate thermal rating such that continuous sequence of the closing and opening operations is possible as long as power supply is available to the motor. It shall also be possible to charge the spring manually and close the breaker in the event of failure of motor / control supply to motor. Operating handle shall be provided for charging the operating mechanism. After failure of control supply to the motor, one open-close-open operation shall be possible with the energy contained in the operating mechanism.
- 6.4.5 The motor rating shall be such that it requires not more than 30 seconds for full charging of the closing spring. Closing action of the circuit breaker shall compress the opening spring ready for tripping. When closing springs are discharged after closing the breaker, they shall be automatically charged for the next operation.
- 6.4.6 Mechanical indicators shall be provided to indicate OPEN/CLOSED positions of the circuit breaker and CHARGED/ DISCHARGED positions of the closing spring. An operation counter shall also be provided. These indicators and counter shall be visible from the panel front door without opening it.

6.5 Relays

- 6.5.1 All relays shall be microprocessor based numerical type. However, auxiliary relays can be static or electromechanical type. The relays shall be flush mounted on panel front with connections from the inside.
- 6.5.2 The relays shall be capable of operating continuously between 80 – 120% of auxiliary voltage.
- 6.5.3 All numerical relays shall have adequate number of freely configurable, optically isolated, Binary Inputs (BI) and potential free Binary Outputs (BO).
- 6.5.4 All numerical relays shall have minimum four no. of current inputs, three for phase current and one for earth current, suitable for CT secondary current of 1A. The current inputs shall be compatible with both residual connected CT and Core Balance CT (CBCT). In addition, numerical relay in main outgoing feeder shall have three no. of voltage inputs for Under Voltage/Over Voltage protection.



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- 6.5.5 All I/O's shall have galvanic isolation. Analog inputs shall be protected against switching surges and harmonics.
- 6.5.6 Making, breaking and continuous capacity of the relay contacts shall be adequate enough for the circuits in which they are used.
- 6.5.7 The numerical relay shall have the following protection functions with at least two independent protection setting groups. The protection functions shall be selectable from any of the IEC characteristic curves.
- (i) Definite time (DT) phase over current protection
 - (ii) Inverse Definite Minimum Time (IDMT) phase over current protection
 - (iii) Definite time (DT) earth fault current protection
 - (iv) Inverse Definite Minimum Time (IDMT) earth fault current protection
 - (v) Under Voltage protection
 - (vi) Over Voltage protection
- 6.5.8 Transformer feeder protection relay shall have provision for the following protection functions.
- (i) Buchholz alarm & trip
 - (ii) Oil Temperature Indicator (OTI) alarm & trip
 - (iii) Winding Temperature Indicator (WTI) alarm & trip
 - (iv) Pressure Relief Valve (PRV) trip
 - (v) Magnetic Oil Gauge (MOG) alarm
- 6.5.9 All numerical relays shall have provision for measurement and storage of electrical parameters such as voltage, current, frequency, active power, reactive power etc.
- 6.5.10 The numerical relay shall be able to record faults and events in non-volatile memory.
- (i) Fault record – At least 5 recent faults including the protection function operated, operating phase(s), voltages and currents along with date and time stamp.
 - (ii) Event record – At least 200 events with date and time stamp.
- 6.5.11 The numerical relay shall have trip circuit supervision facility to monitor the circuit breaker trip circuit both in pre-trip and post-trip conditions. The relay shall also be able to provide circuit breaker monitoring, CT and VT supervision.
- 6.5.12 The numerical relay shall have self-diagnostic feature with separate output contact for indication of any internal relay failure.
- 6.5.13 The numerical relay shall have RS-232/RS-485/RJ-45/USB ports on front side for local communication with PC and on rear side for remote communication to SCADA



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system.

- 6.5.14 The numerical relay shall have feature for time synchronization through the SCADA System / networking.
- 6.5.15 The numerical relay shall be provided with backlit alphanumeric LCD to access protection settings, measurement parameters, fault and event records. Read and write access to protection settings shall be password protected.

6.6 Instrument Transformers

- 6.6.1 Instrument transformers shall be completely encapsulated cast resin type, suitable for continuous operation at the ambient temperature prevailing inside the switchgear enclosure, when the switchgear is operating at its rated load and the outside ambient temperature is 50°C.
- 6.6.2 Polarity marks shall indelibly be marked on each instrument transformer and at the lead terminals at the associated terminal block.
- 6.6.3 Voltage transformers shall be single phase units. Bus voltage transformers shall be housed in a separate panel on withdrawable truck.
- 6.6.4 HRC fuses of suitable rating shall be provided on primary side of voltage transformers. For secondary side, four pole Miniature Circuit Breakers (MCB) shall be provided with its supervision facility.

6.7 Earthing

- 6.7.1 An earth bus made of copper shall be provided throughout the length of the panel. It shall be bolted to the framework of each panel and brazed to each breaker earthing contact bar.
- 6.7.2 The earth bus shall have sufficient cross section to carry maximum fault current without exceeding the allowable temperature rise.
- 6.7.3 All non-current carrying conductors of the panel shall be connected to the earth bus. All joints to the earth bus shall be made through at least two bolts. Hinged doors shall be earthed through flexible earthing braid of adequate cross section. Suitable provision shall be provided at each end of the earth bus for connection with Owner's Earth conductor.
- 6.7.4 Positive earthing of the breaker truck and frame shall be maintained when it is in the connected position and in all other positions whilst the auxiliary circuits are not totally disconnected.
- 6.7.5 All metallic cases of relays, instruments and other panel mounted equipment shall be connected to earth bus by independent copper wires of size not less than 2.5 sq. mm



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with green colour insulation.

- 6.7.6 Instrument transformer secondary neutral point shall be earthed at one place only on the terminal block. Such earthing shall be made through links so that earthing of one circuit may be removed without disturbing the earthing of other circuits.
- 6.7.7 Separate earthing trucks shall be provided for earthing of busbars and incoming/outgoing feeders. The trucks shall have voltage transformer to indicate presence of voltage prior to earthing. An audible alarm shall also be provided in case of voltage on the earthing terminal. Integral earth switches may also be considered instead of earthing trucks. The earthing truck/switch shall have short circuit withstand capability equal to that of the associated switchgear panel.
- 6.7.8 The interlocks shall be provided to ensure the following.
- (i) It is not possible to rack-in the earthing truck/close the earthing switch when the breaker truck is in SERVICE position.
 - (ii) It is not possible to rack-in the breaker truck into SERVICE position when earthing truck is connected/earthing switch is in closed position.

6.8 Bus bar

- 6.8.1 Bus bar shall be made of copper or aluminium with uniform cross section throughout their length. They shall be adequately supported on insulators to withstand electrical and mechanical stresses due to specified short circuit current.
- 6.8.2 All bus bars joints shall be thoroughly cleaned and anti-oxide grease shall be applied. Plain and spring washers shall be provided to ensure good contacts at the joints and taps. Wherever aluminium to copper connections are required, suitable bimetallic connectors or clamps shall be used.
- 6.8.3 Bus bars shall be provided with heat shrinkable sleeves of suitable insulation class throughout their length with proper colour coding. All bus bar joints and taps shall be shrouded.
- 6.8.4 Bus bar support insulators shall be made of non-hygroscopic, arc and track resistant, high strength material suitable to withstand stresses due to over voltage and short circuit current.
- 6.8.5 The Contractor shall submit busbar sizing calculation for specified continuous and short time current ratings during detailed engineering.

6.9 Measuring Instruments

- 6.9.1 All the measuring instruments shall be digital, flush mounting type with communication facility.



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6.9.2 All feeders except main outgoing feeder shall be provided with digital Multi-Function Meter (MFM). Tri Vector Meter (TVM) shall be provided for the main outgoing feeder (in the HT Panel). Accuracy class of MFM shall be 0.2 and that of TVM shall be 0.2S.

6.9.3 Measuring instruments shall have provision to display the following parameters.

- (i) Line and phase voltages
- (ii) Line and phase currents
- (iii) Active power, Reactive power, Apparent power
- (iv) Frequency
- (v) Power factor
- (vi) Total Harmonic Distortion (THD)

6.10 Wiring and Terminal blocks

6.10.1 All internal wiring shall be done with 650 V grade, 1.5 sq.mm. PVC insulated stranded flexible copper wire. For CT secondary circuits, 2.5 sq.mm copper wire shall be used.

6.10.2 Wire terminations shall be made with solderless crimping type tinned copper lugs, which shall firmly grip the conductor. Insulation sleeves shall be provided at all the wire terminations.

6.10.3 Printed identification ferrules, marked to correspond with panel wiring diagram shall be provided at both ends of each wire. The ferrules shall be firmly located on each wire so that they cannot move or turn freely on the wire. Wire identification shall be done in accordance with IS 11353.

6.10.4 The Contractor shall be solely responsible for the completeness and correctness of the internal wiring and for the proper functioning of the connected equipment.

6.10.5 All internal wiring to be connected to the external equipment shall terminate on terminal blocks. Terminal blocks shall be rated for 650 V, 10 A and made of non-inflammable material.

6.10.6 CT and VT secondary circuits shall be terminated on stud type, non-disconnecting terminal blocks.

6.10.7 At least 10% spare terminals shall be provided on each panel and these spare terminals shall be distributed on all terminal blocks.

6.11 Warranty

The HT panel unit shall be warranted against all material/ manufacturing defects and workmanship for minimum of 2 (two) years from the date of supply.

6.12 Testing and Inspection



6.12.1 Type Tests

The switchgear panel shall be of type tested design. The following type test reports shall be submitted during detailed engineering. The tests should have been conducted on the similar equipment by NABL accredited laboratory.

Test	Standard	Relevant IEC Clause
Switchgear Panel		
Dielectric tests		
Power frequency voltage test	IEC 62271-200	6.2.6.1
Lightning impulse voltage test	IEC 62271-200	6.2.6.2
Dielectric tests on auxiliary and control circuits	IEC 62271-200	6.2.10
Measurement of the resistance of the main circuit	IEC 62271-200	6.4.1
Temperature-rise tests	IEC 62271-200	6.5
Short-time withstand current and peak withstand current tests	IEC 62271-200	6.6
Verification of the IP coding	IEC 62271-200	6.7.1
Verification of making and breaking capacities	IEC 62271-200	6.101
Mechanical operation test	IEC 62271-200	6.102
Internal arc test	IEC 62271-200	6.106
Circuit Breaker		
Mechanical operation test at ambient air temperature (M2 Class)	IEC 62271-100	6.101.2
Basic short-circuit test-duties	IEC 62271-100	6.106
Relays		
Vibration tests	IEC 60255-21-1	
Shock and bump tests	IEC 60255-21-2	
Seismic tests	IEC 60255-21-3	
Electromagnetic compatibility requirements	IEC 60255-26	
Product safety requirements	IEC 60255-27	
Common requirements	IEC 60255-1	



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Functional requirements	Relevant parts of IEC 60255-100 series	
Communication requirements	IEC 61850	
Current Transformers		
Temperature-rise test	IEC 61869-2	7.2.2
Impulse voltage withstand test on primary terminals	IEC 61869-2	7.2.3
Tests for accuracy	IEC 61869-2	7.2.6
Short-time current tests	IEC 61869-2	7.2.201
Voltage Transformer		
Temperature-rise test	IEC 61869-3	7.2.2
Impulse voltage withstand test on primary terminals	IEC 61869-3	7.2.3
Test for accuracy	IEC 61869-3	7.2.6
Short-circuit withstand capability test	IEC 61869-3	7.2.301

In case the contractor is not able to submit the test reports during detailed engineering, the contractor shall submit the reports of type/special tests either conducted by NABL accredited laboratory or witnessed by Employer.

6.12.2 Routine Tests

Routine tests and acceptance tests shall be as per the Quality Assurance Plan (QAP) approved by the Employer.

7 AC Cables

7.1 Standards and Codes

All AC Cables shall conform to the following standards and codes.

IS 7098	Crosslinked Polyethylene Insulated Thermoplastic Sheathed Cables, Part 1: For working voltage up to and including 1100 V
IS 7098	Crosslinked Polyethylene Insulated Thermoplastic Sheathed Cables Part 2: For working voltages from 3.3 kV up to and including 33 kV

7.2 All AC cables shall be flame retardant, low smoke (FRLS) type designed to withstand all mechanical, electrical and thermal stresses develop under steady state and transient operating conditions.

7.3 Only terminal cable joints shall be accepted. No cable joint to join two cable ends shall

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be accepted. However, cable joints may be allowed if the route length is more than maximum available drum length subject to Employer's approval.

7.4 In addition to manufacturer's identification on cables as per relevant standard, following marking shall also be provided over outer sheath.

- (i) Cable size and voltage grade
- (ii) Word 'FRLS' at every metre
- (iii) Sequential marking of length of the cable in metres at every metre

7.5 Cables shall be sized based on the following considerations:

- (i) Rated current the equipment
- (ii) In case of Central inverters, maximum voltage drop in LT cable (from PCU to inverter transformer) shall be limited to 0.5% of the rated voltage. In case of String inverters, maximum voltage drop (from string inverter to LT combiner panel and from LT combiner panel to Inverter duty transformer) shall be limited to 1.5%. For HT cables (from inverter transformer to plant take off point), maximum voltage drop shall be limited to 0.5 % of the rated voltage. The Contactor shall provide voltage drop calculations in excel sheet.
- (iii) Short circuit withstand capability as per design for 1s.
- (iv) De-rating factors according to laying pattern

7.6 Warranty

All cables shall be warranted against all material/ manufacturing defects and workmanship for minimum of 1 (one) year from the date of supply.

7.7 Testing

Type, routine and acceptance tests requirements shall be as per relevant standards for all cable sizes.

7.8 Installation

7.8.1 Cable installation shall be as per IS 1255.

7.8.2 All AC Cables shall be laid along overground cable trays with cable cleats/ties ensuring minimum clearance of 500 mm above FGL. Cable trays shall be as per Clause 3.8.8 of Technical Specifications.

7.8.3 Cable terminations shall be made with properly crimped lugs and passed through cable glands at the entry & exit point of the cubicles. Bimetallic lugs shall be used for connecting Cu bus bar and Al cables or vice-versa.

7.8.4 All AC cables shall be provided with punched/embossed aluminium tags. The



marking shall be done with good quality letter and numbers of proper size so that the cables can be identified easily.

8 Auxiliary Supply System

- 8.1 Scheme for Auxiliary supply system shall be submitted by contractor during detailed engineering for the approval by Employer.
- 8.2 It shall mainly comprise of auxiliary transformer, AC distribution board(s) (ACDB), Battery & battery charger system, emergency lighting network, Uninterrupted power supply (UPS), distribution cables and metering & protective devices.
- 8.3 Auxiliary system shall be provided with two independent sources for reliable auxiliary power supply.
- 8.4 Following consideration shall be taken into account while sizing the auxiliary transformer:
- (i) 20% future load margin
 - (ii) 20% design margin
 - (iii) Total connected load at 0.8 power factor

9 LT Switchgear

9.1 Standards and Codes

All equipment provided under LT switchgear shall comply with latest revisions and amendments of the relevant IEC standards and IS codes. In particular, the switchgear shall comply with the following standards and codes.

Standard/Code	Description
IEC 61439-1	Low-voltage switchgear and control gear assemblies - Part 1: General rules
IEC 61439-2	Low-voltage switchgear and control gear assemblies - Part 2: Power switchgear and control gear assemblies
IEC 60947-1	Low-voltage switchgear and control gear - Part 1: General rules
IEC 60947-2	Low-Voltage Switchgear and Control gear: Circuit Breakers
IEC 60947-3	Low voltage switchgear and control gear: Part 3 Switches, disconnectors, switch-disconnectors and fuse combination units
IEC 60947-4-1	Low-voltage switchgear and control gear - Part 4-1: Contactors and motor-starters - Electromechanical contactors and motor-starters



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IEC 60947-5-1	Low-voltage switchgear and control gear - Part 5-1: Control circuit devices and switching elements - Electromechanical control circuit devices
IEC 62052-11	Electricity metering equipment (a.c.) - General requirements, tests and test conditions - Part 11: Metering equipment
IS 694	Polyvinyl chloride insulated unsheathed-and sheathed cables/ cords with rigid and flexible conductor for rated voltages - up to and including 450/750V
IEC 61869	Instrument Transformers
IS 3043	Code of practice for earthing
IEC 60255	Measuring relays and protection equipment - Part 1: Common requirements

9.2 Technical Parameters

System Details	
Rated system voltage	415 V \pm 10%, 3 Phase, 50Hz, 4 wire, Neutral Solidly Earthed
Digital Multifunctional Meter (MFM)	
Accuracy class	0.5 class for main distribution board at main control room and 0.5 class for DB at inverter room(s)
Communication with SCADA	RS485 communication with Modbus RTU
Current transformer (CT)	
Type	Cast Resin Bar Primary
Voltage class and frequency	650 V, 50 Hz
CT Secondary Current	1 or 5 A
Class of insulation	Class F
Accuracy class & burden	
a) For Protection	5P20, 5VA PS Class for REF and core balance CT (CBCT)
b) For Metering	Class 0.5, 5VA (min)
Minimum primary earth fault current to be detected by CBCT	1 A
Instrument Security Factor for metering CT	5
Voltage transformer (VT)	



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Type	Cast Resin
Accuracy class	0.5
Rated Voltage factor	1.1 continuous, 1.5 for 30 seconds
Class of insulation	E or better
Moulded case circuit breaker (MCCB)	
Rated voltage	415V
Release	Thermal-Magnetic/Microprocessor
Rated current	As per system requirement
Poles	4 poles
Rated insulation level	690V
Rated ultimate and service short circuit breaking Capacity	As per system requirement
Rated Making capacity (as per system requirement)	2.1 x Short circuit breaking capacity
Utilization category	A

9.3 Constructional Details

- 9.3.1 The panel shall be metal enclosed, free standing, floor mounted, modular type with compartmentalized construction having degree of protection of IP 5X (Indoor) and IP 55 (Outdoor) as per IS/IEC 60529. All doors and covers shall be provided with neoprene gaskets to prevent entry of vermin and dust.
- 9.3.2 All switches, push buttons etc. shall be operated front and shall be flush/semi-flush mounted.
- 9.3.3 The panel shall be fabricated from 2 mm CRCA sheet steel for frame & load bearing surfaces. Partitions may be fabricated from 1.6 mm CRCA if no components are mounted on them.
- 9.3.4 Cable entries shall be from bottom. The opening of cable entry shall be covered by 3mm thick gland plates with proper sealing to avoid water and rodent entry.
- 9.3.5 Earthing bus bar of suitable cross section shall be provided throughout the length of panel.
- 9.3.6 The panel shall be duly wired with suitable size of 1.1 kV, PVC insulated cable and terminals shall be brought out for cable connections. 10% spare terminals subjected to minimum one of each rating shall be provided on each distribution switchgear. All wire shall have ferrules as per wiring diagram.
- 9.3.7 Indoor panels shall be painted with 2 coats of primer after pre-treatment and 2 coats



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of Polyurethane / epoxy paint with shade as decided by the Owner. The minimum dry film thickness (DFT) shall be 50 microns. Outdoor panels shall be painted according to C5 (High) corrosive category as per ISO 12944-5.

- 9.3.8 The panel shall be of dead front construction suitable for front operated and back maintained functioning.
- 9.3.9 240 V, 5 A, 3 pin industrial socket-outlet with ON/OFF switch shall be provided in each panel.
- 9.3.10 Each panel shall be provided with LED lamp rated for 240 V, 50 Hz, single phase AC supply for interior illumination controlled by door switch.
- 9.3.11 Suitable lifting hooks shall be provided for each panel.
- 9.3.12 Each switchgear panel shall be provided with thermostatically controlled space heaters to prevent condensation within the enclosure. The space heater shall be connected to 240 V, 50 Hz, single phase AC supply through suitable switch and fuse.
- 9.3.13 Earth leakage relay with Core balance CTs (CBCT) shall be provided on main incoming feeders having phase CT ratio more than 50/1A. CBCT's shall be circular window type with window size based on the overall diameter of the cables, to be finalized during detailed engineering.

9.4 Warranty

Distribution panels (ACDB and DCDB) shall be warranted against all material/manufacturing defects and workmanship for minimum of 1 (one) year from the date of supply.

9.5 Testing

Routine test and acceptance tests requirements shall be as per relevant standards for all cable sizes.

10 Uninterrupted Power Supply

10.1 Standards and Codes

Standard/Code	Description
IEC 62040-1	Uninterruptible power systems (UPS) – Part 1: General and safety requirements for UPS
IEC 62040-2	Uninterruptible power systems (UPS) – Part 2: Electromagnetic compatibility (EMC) requirements
IEC 62040-3	Uninterruptible power systems (UPS) – Part 3: Method of specifying the performance and test requirements

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10.2 General Requirements

10.2.1 The Uninterrupted Power Supply (UPS) system shall be designed to supply power to following loads (but not limited to).

- (i) Data logger / SCADA
- (ii) Fire Detection/ Alarm Panel
- (iii) HMI of SCADA
- (iv) Emergency Lighting
- (v) Inverter's Auxiliary supply (if applicable)
- (vi) HT panel auxiliary
- (vii) CCTV

10.2.2 Sizing of UPS shall be done considering the above-mentioned load at power factor of 0.8 lagging inclusive of 10% design margin at 50 °C.

10.3 System Description

10.3.1 The UPS shall automatically provide continuous, regulated AC power to critical loads under normal and abnormal conditions, including loss of input AC power. The UPS system shall consist of the following major equipment.

- (i) UPS Module
 - (a) Insulated Gate Bipolar Transistor (IGBT) Converter
 - (b) Insulated Gate Bipolar Transistor (IGBT) Inverter
 - (c) Digital Signal Processor (DSP) using Pulse Width Modulation (PWM) for Direct Digital Control (DDC) of all UPS control and monitoring functions
 - (d) Static bypass switch
- (ii) Battery system for 2 hours
- (iii) Battery protective and disconnect device
- (iv) Maintenance bypass switch
- (v) LCD display panel and LED indications
- (vi) Integrated UPS Communications Protocols capable of communicating with SCADA system

10.3.2 The UPS shall meet the following minimum specifications.

Parameter	Specification
Topology	Online double conversion UPS
Input	



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Voltage	230 V \pm 10% AC
Frequency	50 \pm 5 Hz
Power factor	0.95
Output	
Voltage	230V \pm 1% AC
Frequency	50 Hz
Power factor	0.8
Battery	
Type	Sealed, Maintenance-Free (AGM) battery
Capacity	100% UPS load for 2 hours
Monitoring and communication	
LED Indicators	Load on Inverter, Battery operation, Load on Bypass, Overload, LCD Fault, UPS Fault
Electrical contacts	Closing contacts for each of the following conditions: 1. Unit on Battery 2. Low Battery 3. Summary Alarm 4. UPS On 5. Input Fail
Local Display	LCD/ LED
SCADA communications	RS-485 Interface Port
Overall efficiency	>90%
Electrical Protection	Input/ output under voltage, over temperature, overload, Short circuit, battery low trip

10.3.3 The UPS shall be forced air cooled by internally mounted fans. The fans shall be redundant in nature to ensure maximum reliability. The fans shall be easily replaceable without the use of special tools.

10.3.4 Contractor shall provide the Operation & Maintenance Manual and mandatory spare parts list along with the equipment

10.4 Warranty

UPS shall be warranted for minimum of 5 (five) years and batteries shall be warranted for a minimum of 2 (two) years against all material/ manufacturing defects and workmanship from the date of supply.



10.5 Tests

- 10.5.1 Routine tests and acceptance tests on final product shall be done as per QAP approved by the Employer.
- 10.5.2 On completion of installation and commissioning of the equipment on site tests shall be carried out with the max. available load, which does not exceed the rated continuous load. An on-site test procedure shall be submitted by contractor include a check of controls and indicators after installation of the equipment.

11 **Battery and Battery Charger**

11.1 Standards and Codes

Standard/Code	Description
IEC 60896-22:2004	Stationary lead-acid batteries – Part 22: Valve regulated types – Requirements
IEC 60896-21:2004	Stationary lead-acid batteries – Part 21: Valve regulated types – Methods of test
IS 1652	Specification for stationary cells and batteries, lead acid type (with plante positive plates)
IS 8320	General requirements and methods of tests for lead acid storage batteries.
IS 15549	Stationary Regulated Lead Acid Batteries

11.2 General

110 V / 220 V DC system (Battery, Battery Charger & DCDB) in accordance with this specification and standards stated herein, shall comprise of the following.

- (i) Sealed Maintenance Free (VRLA) Battery complete with racks & accessories.
- (ii) One No. Float charger.
- (iii) One No. Float cum Boost charger.
- (iv) DC Distribution Board (DCDB)

11.3 Battery

- 11.3.1 Battery shall be used to supply the following loads with back up of two hours in case of complete power failure:
- (i) Trip and closing coil of HT circuit breaker
 - (ii) Spring charging motors for HT circuit breaker
 - (iii) Annunciator and Indication circuit of HT panel
 - (iv) Auxiliary supply to protection relays



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- 11.3.2 The battery sizing shall account for suitable temperature correction factors, ageing factors of 1.25, design margin of 1.25 & depth of discharge of 80%.
- 11.3.3 The design of the battery bank and sizing calculation along with the data sheet for the battery and battery charger shall be submitted for approval.
- 11.3.4 Battery voltage – 220V dc or 110V dc
- 11.4 Battery Charger
- 11.4.1 The Float Charger shall be used to supply normal DC loads and float charging current of charged battery. The Float cum Boost charger shall be designed to supply boost charging current requirement of the associated battery as well as to supply normal DC load. After full discharge of battery bank, the Float Cum boost charger shall be capable of charging the battery to its full capacity in 8 hours duration while supplying normal DC load.
- 11.4.2 The float charger shall have both auto and manual voltage regulation arrangements with provision of selector switch.
- 11.4.3 Suitable filter circuits shall be provided in all the chargers to limit the ripple content (peak to peak) in the output voltage and current to 2% and 5% respectively.
- 11.4.4 Digital Outputs shall be configured for connection to the SCADA to monitor the outputs like charger output current, output voltage, float/boost mode, etc.
- 11.4.5 The charging equipment shall be housed in a free standing, floor mounted compartmentalized panels. Panel shall have provision for bottom cable entry with removable undrilled cable gland plate of 3.0 mm thickness.
- 11.4.6 The panel shall be of CRCA sheet steel construction having thickness of at least 2.0 mm. Degree of protection provided by the enclosure to the internals of charger shall be IP 42.
- 11.4.7 The instruments, switches and indicating lamps shall be flush mounted on the front panel.
- 11.5 DC distribution board (DCDB)
- 11.5.1 DCDB shall be an integral part of battery charger panel board.
- 11.5.2 Doors and covers shall be provided with neoprene gaskets to prevent entry of vermin and dust. Also, door shall be provided with lock and key arrangement to prevent unauthorized access to the board.
- 11.5.3 DCDB shall have adequate number of outgoing feeders with double pole, DC MCBs. At least 20% feeders shall be provided as spare.



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11.6 Warranty

Batteries and battery charger shall be warranted against all material/ manufacturing defects and workmanship for minimum of 2 (two) years from the date of supply.

11.7 Tests

Routine tests and acceptance tests shall be as per the Quality Assurance Plan (QAP) approved by the Employer.

12 **Earthing**

12.1 Standards and Codes

Earthing system shall comply with latest revisions and amendments of the relevant IEC standards and IS codes. In particular, earthing system shall comply with the following standards and codes.

Standard/Code	Description
IS 3043	Code of Practice for Earthing
IEC 62561-2	Requirements for conductors and earth electrodes
IEC 62561-7	Requirements for earthing enhancing compounds
IEEE 80	IEEE Guide for Safety in AC Substation Grounding
IEEE 142	IEEE Recommended Practice for Grounding of Industrial and Commercial Power Systems
Indian Electricity Rules	

12.2 General Requirements

12.2.1 Earthing system shall be designed based on system fault current and soil resistivity value obtained from geo-technical investigation report. Earth grid shall be formed consisting of number of earth electrodes sufficient enough to dissipate the system fault current interconnected by earthing conductors.

12.2.2 The earth electrode shall be made of high tensile low carbon steel rod, molecularly bonded by high conductivity copper on outer surface with coating thickness not less than 250 micron as per relevant standards. Suitable earth enhancing material shall be filled around the electrode to lower the resistance to earth. Inspection chamber and lid shall be provided as per IS 3043.

12.2.3 Earth conductors shall be made of copper bonded steel or galvanized steel of sufficient cross section to carry the fault current and withstand corrosion.

12.2.4 Earth conductors buried in ground shall be laid minimum 600 mm below ground level



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unless otherwise indicated in the drawing. Back filling material to be placed over buried conductors shall be free from stones and harmful mixtures.

- 12.2.5 Earth electrodes shall not be situated within 1.5m from any building whose installation system is being earthed. Minimum distance between earth electrodes shall be two times the driven depth of the electrode.
- 12.2.6 Transformer yard and switchyard fence shall be connected to the earth grid by one GS flat and gates by flexible lead to the earthed post.
- 12.2.7 All welded connections shall be made by electric arc welding. For rust protection, the welds should be treated with red lead compound and afterwards thickly coated with bitumen compound.

12.3 Earthing of PV array field

- 12.3.1 All PV Modules, Module Mounting Structures (MMS) and String Combiner Box (SCB) structures in the PV array field shall be bonded to the earthing system by two distinct connections.
- 12.3.2 Each PV Module frame shall be earthed using copper wire of sufficient cross section. The copper wire shall be connected to the earth hole provided in the module frame using suitable arrangement in line with the manufacturer recommendation. The earthing arrangement shall use stainless washers to prevent galvanic corrosion between aluminium frame and copper wire. In order to achieve effective earthing, serrated washers shall be employed to penetrate the anodization layer of the module frame.
- 12.3.3 Continuous copper earthing wire shall be run to connect a group of modules and both ends of the loop shall be bolted to the DC earth grid using bimetallic lugs and stainless-steel fasteners. The copper earthing wire shall be routed in such a way to avoid physical contact with the module aluminium frame.
- 12.3.4 The connection between MMS and DC earth grid shall be bolted or welded. Portion of the MMS which undergoes welding at site shall be coated with two coats of cold galvanising and anti-corrosion paint afterwards.
- 12.3.5 Earth electrodes of the DC earth grid shall be uniformly distributed throughout the PV array field so that optimum earth resistance is offered to leakage current flowing from any module frame or MMS.
- 12.3.6 SCB equipment earthing point shall be connected to the DC earth grid using flexible copper cable of sufficient cross section as recommended by the manufacturer. The connection with the DC earth grid shall be done using suitable bimetallic lugs and



stainless-steel fasteners.

12.4 PCU Earthing

DC negative bus bar of the PCU shall be earthed to avoid Potential Induced Degradation (PID). DC negative bus bar and PCU equipment earth shall be bonded to the PCU earth bus and connected to earth electrodes through flexible copper cable of sufficient cross section as mentioned by the manufacturer. The interconnection of PCU earth electrodes with DC earth grid shall be as per PCU manufacturer recommendation. In case DC negative grounding is not possible, appropriate anti-PID device shall be provided.

12.5 Transformer Earthing

12.5.1 Inverter transformer neutral shall be floating, not to be earthed. However, recommendation of inverter manufacturer shall also be taken into account.

12.5.2 Transformer tank, cable box, marshalling box and all other body earth points shall be earthed.

12.5.3 Inverter transformer shield shall be earthed separately using minimum two no. of earth electrodes. Earthing conductor between shield bushing and earth electrodes shall be copper flat of suitable size not less than 25 x 6 mm.

12.5.4 Neutral and body of the auxiliary transformer shall be earthed.

12.6 Inverter Room and Main Control Room Earthing

12.6.1 Metallic enclosure of all electrical equipment inside the inverter room and main control room shall be connected to the earth grid by two separate and distinct connections.

12.6.2 Cable racks and trays shall be connected to the earth grid at minimum two places using galvanized steel flat.

12.6.3 SCADA and other related electronic devices shall be earthed separately using minimum two no. of earth electrodes.

12.7 Switchyard Earthing

The metallic frame work of all switchyard equipment and support structures shall be connected to the earth grid by means of two separate and distinct connections.

Switchyard shall be shielded against direct lightning stroke by provision of over head shield wire or earth wire or spikes(masts) or a combination there of as per CEA regulations 2010 (Technical standards)- 42(2)I.

12.8 Tests



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Type test reports for earthing electrode, earth enhancing compound and its associated accessories shall be submitted during detailed engineering for approval.

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.

The earth plate shall be provided to facilitate its identification and for carrying out periodical inspection.

13 Lightning Protection System

- 13.1 Lightning Protection System (LPS) for entire plant against direct and indirect lighting strokes shall be provided as per IS/IEC 62305:2010.
- 13.2 Lightning Protection Level for the entire plant shall be Level-III.
- 13.3 Air terminals, down conductors and earth termination system shall be designed as per relevant parts of IS/IEC 62305:2010.
- 13.4 Necessary foundation/anchoring for holding the lightning mast in position to be made after giving due consideration to shadow on PV array, maximum wind speed and maintenance requirement at site in future.
- 13.5 The product shall be warranted for minimum of 2 (two) years against all material/manufacturing defects and workmanship.
- 13.6 Type test reports as per IEC 62305:2010 shall be submitted during detailed engineering for approval.

14 Communication Cables

14.1 Optical Fibre Cables

- 14.1.1 Optic Fibre cable shall be 4/8/12 core, galvanized corrugated steel taped armoured, fully water blocked with dielectric central member for outdoor/ indoor application so as to prevent any physical damage.
- 14.1.2 The cable shall have multiple single-mode or multimode fibres on as required basis so as to avoid the usage of any repeaters.
- 14.1.3 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.
- 14.1.4 The cable core shall have suitable characteristics and strengthening for prevention of damage during pulling.



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- 14.1.5 All testing of the optic fibre cable being supplied shall be as per the relevant IEC, EIA and other international standards.
- 14.1.6 The Contractor shall ensure that minimum 100% cores are kept as spare in all types of optical fibre cables.
- 14.1.7 Cables shall be suitable for laying in conduits, ducts, trenches, racks and underground buried installation.
- 14.1.8 Spliced/ Repaired cables are not acceptable. Penetration of water resistance and impact resistance shall be as per IEC standard.

14.2 Communication Cable (Modbus)

- 14.2.1 Data (Modbus) Cable to be used shall be shielded type with stranded copper conductor. Cable shall have minimum 2 pair each with conductor size of 0.5 Sq.mm. Cable shall be flame retardant according to IEC 60332-1-2.
- 14.2.2 Cable shall be tested for Peak working voltage of not less than 300 V and shall be suitable for serial interfaces (RS 422 and RS 485).
- 14.2.3 Communication cable shall be laid through underground with suitable HDPE ducts.

15 **SCADA**

15.1 General Requirements

- 15.1.1 The Contractor shall provide complete SCADA system with all accessories, auxiliaries and associated equipment and cables for the safe, efficient and reliable operation and monitoring of entire solar plant and its auxiliary systems.
- 15.1.2 The Contractor shall provide all the components including, but not limited to, Hardware, Software, Panels, Power Supply, HMI, Laser Printer, Gateway, Networking equipment and associated Cables, firewall etc. needed for the completeness.
- 15.1.3 SCADA System shall have the provision to perform the following features and/or functions:
- (i) Web enabled Operator Dashboards: Showing key information on Generation, Performance and Current Status of various equipment in Single Line Diagram (SLD) format with capability to monitor PV array Zone level (i.e. SCB level) parameters.
 - (ii) Real time Data Logging with Integrated Analytics & Reporting: Logging of all parameters - AC, DC, Weather, System Run Hours, Equipment Status and Alarms as well as derived/ calculated/ integrated values. The SCADA User



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interface shall be customizable and enable Report Generation and Graphical Analysis.

- (iii) Fault and System Diagnostics with time stamped event logging.
- (iv) Support for O&M Activities: The interface shall allow integration with Module Cleaning System and various other O&M support systems to provide a Data Analysis and Decision Support System for smooth and efficient Plant Operations.
- (v) AI based Distributed Analytics for Predictive Maintenance, trend analysis and Alerts.
- (vi) Generate, store and retrieve user configurable Sequence of Event (SOE) Reports.
- (vii) Interface with different field equipment in the plant and work seamlessly with field equipment supplied by different companies.
- (viii) Transfer of plant data reliably, to a Cloud server on any kind of remote network including low bandwidth and wireless links such as 2G/3G/VSAT

(Note: Telecom Lease line connection, if required for transferring data from Plant over internet shall be taken by Contractor in the name of Employer for O&M period)

- 15.1.4 The Control system shall be designed to operate in non-air-conditioned area. However, the Contractor shall provide a Package/ Split AC of suitable capacity decided by heat load requirement in SCADA room at Main Control Room.

15.2 Architecture

- 15.2.1 The SCADA System shall be built over Industrial IoT architecture with integrated Analytics, secure web access, enterprise software and Database.
- 15.2.2 Data acquisition shall be distributed across MCR and LCRs while plant level data aggregation shall be done in both local and remote server (as specified by Owner).
- 15.2.3 Analog and Digital IO modules shall have integrated processor for distributed IO processing and control.
- 15.2.4 Data communication system shall be built over fibre optic cables/ wireless network with high bandwidth TCP/IP communication (Fast Ethernet or 802.11a/b/g/n) across all Inverter and Control Rooms with Internet/Intranet access at Main Control Room. Firewall shall be provided for network security.
- 15.2.5 Plant SCADA Server shall have Industrial Grade server hardware running SCADA & Monitoring Software with data storage (complete plant data) space for 2 years.
- 15.2.6 Plant data for monitoring and control operations should be accessible without



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dependence on external network.

- 15.2.7 A virtual/cloud server running SCADA & Monitoring Software shall be configured in parallel with Plant Server to enable easy access to plant data from outside the plant without having to login to plant server. Effectively, the plant data shall be replicated in both places i.e. between systems at the Plant Server and Remote Server to provide data redundancy for complete plant data.

Note: Configuration of Cloud server and procurement of associated subscription services shall be in the scope of the EPC Contractor.

- 15.2.8 Operator Workstation/PC shall be of Industrial Grade for browser-based access to plant data from Plant or remote server. Plant control & SLDC/Utility related operations shall only be initiated through browser-based interface requiring no client software or database to be installed on the Workstation. All critical software and Plant Data shall be installed/stored on local and remote servers only with user access control for protecting the software and data assets from accidental deletion or corruption.

- 15.2.9 Internet/Intranet at Plant: Public or private network access shall be provided at the plant through any broadband/VSAT connectivity of 2Mbps or higher bandwidth. In case no broadband/VSAT connectivity can be provided at the plant, a 3G/4G data card from any Internet Service Provider (ISP) may be provided. SCADA system shall be capable of sending all plant data in real time to the Remote Server.

- 15.2.10 GPS based Time Synchronization System: The SCADA system shall have a Master/Slave Clock system along with antenna, receiver, cabinet and internal interconnection cables. All SCADA controllers, servers, OWS and communicating equipment shall be synchronized to the GPS clock.

15.3 Industrial IoT Controllers & Data Acquisition

The Plant SCADA and Monitoring System may use one or more IIoT Controllers at each Inverter Control Room and MCR for the purpose of data acquisition and data forwarding to the Local and Remote SCADA Servers. The IIoT Controllers shall meet the following minimum requirements:

- 15.3.1 The IIoT Controllers shall be distributed in nature and work independently of other IIoT Controllers or any central controller in the system.
- 15.3.2 Shall be capable of supporting wide range of field protocols to communicate with different field equipment (Modbus over RS485/Ethernet, etc.)
- 15.3.3 Shall have local storage for a minimum of 2 weeks (in case of network failure).
- 15.3.4 Provide web-based interface to configure the controller for various equipment in the



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field.

- 15.3.5 IO Functionality: Shall support status monitoring of VCBs & Trip relays on RMU/HT & Transformer panels through distributed DI/AI modules.
- 15.3.6 Controls: Shall be capable of Controlling breakers (ON/OFF). Both ON/OFF and Parameter control of inverters shall be supported.
- 15.3.7 Data Communication with Servers: Shall send the data collected, from all the equipment at Inverter Control Room and/or Main Control Room, to the Monitoring & Control Server.
- 15.3.8 Controllers shall be capable of sending data over Internet connections USB data cards.
- 15.3.9 Shall not require a static public IP address, at the plant for the purpose of remote access.

15.4 Functionalities

- 15.4.1 SCADA system shall enable PV array Zone monitoring i.e. the total current from each String Combiner Box shall be monitored on the DC side of the inverter (Central).
- 15.4.2 The SCADA system shall monitor instantaneous and cumulative electrical parameters from all DC& AC Equipment including inverters, weather station, MFM, Transformer and Switchgear (LT & HT Panels) at regular intervals not greater than one minute.
- 15.4.3 The SCADA system shall monitor Instantaneous and cumulative environment parameters from weather sensors or data loggers at same interval as electrical parameters and provide PR, CUF on the fly.
- 15.4.4 The SCADA system shall provide Alarms and Alerts on equipment faults and failure in less than 5 seconds. Alarms on status change of hardwired DI shall also be provided.
- 15.4.5 The SCADA system shall provide configurable alerts on any parameter crossing settable thresholds. The list of such parameters shall be finalised in consultation with the Owner.
- 15.4.6 The SCADA system shall enable integration with other sub-systems at the plant for supporting O&M activities. The list shall include but not limited to:
 - (i) Module Cleaning System – For monitoring of water usage and efficacy of cleaning process (in case of Wet Type Cleaning System).
- 15.4.7 The SCADA system shall have user-friendly browser-based User Interface for secure access from anywhere, for minimum ten concurrent connections from the Operator



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PC or other securely connected laptop/mobile, for plant monitoring, O&M, daily reporting, and analysis. A dashboard providing summary details of total plant generation, day's export, irradiance, Inverter Control Room level generation and performance indicators like PR and CUF.

- 15.4.8 Reporting: The SCADA system shall provide downloadable reports in Excel/PDF, configurable for equipment parameters across the plant.
- 15.4.9 The system shall have Configurable Analysis page for self-configured as well as on demand Analytics charts.
- 15.4.10 The SCADA system shall be extensible to include maintenance of O&M schedules and related activities for plant equipment as per the O&M Manual.
- 15.4.11 Connectivity shall be provided to Owner's Data Monitoring Centre. Data collected by Plant SCADA shall be replicated in real-time, using industry standard interfaces such as Web Services, OPC-UA, data files, as required – with Owner's Central Monitoring System in New Delhi. The data recording intervals for different parameters from different devices in the solar plant shall be considered when creating schedules to "push" the data from Plant SCADA to data receivers stationed at New Delhi.
- 15.4.12 Mobile User Interface: summary of plant performance and issues should be accessible in a mobile Native UI or browser UI.
- 15.4.13 Data Communication to SLDC: SCADA system shall provide required interface to integrate with TRANSCO-SLDC, in compliance with grid code, to send any parameters specified by SLDC.
- Note: The methodology and specification of SLDC interface will be provided separately by SLDC/TRANSCO and it shall be the responsibility of the Contractor to determine the same.
- 15.4.14 Power Plant Control: SCADA system shall provide required interface to the local SCADA operator to set various power control modes (active/reactive power/frequency/PF) through the inverters over industry standard communication protocols like Modbus over TCP/IP.
- 15.4.15 Forecasting and Scheduling: SCADA shall provide day ahead and week ahead forecasting and scheduling for power generation at the plant as per SLDC/Utility stipulations.
- 15.4.16 Predictive Maintenance: SCADA system shall have in-built or pluggable frameworks to support AI based Predictive Maintenance for all key equipment including inverters, transformers and switchgear at the plant.



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15.4.17 All programming functionalities shall be password protected to avoid unauthorized modification.

15.4.18 The Contractor shall provide software locks and passwords to Employer for all operating & application software. Also, the Contractor shall provide sufficient documentation and program listing so that it is possible for the Employer to carry out modification at a later date.

15.5 Earthing

15.5.1 Two isolated electronic earth pits near to SCADA panel at every Inverter and Control Room with < 1 Ohm resistance shall be provided. One earth pit shall be used for protective/body earth and the other to be used for Signal Earth.

15.5.2 Apart from providing separate earth pits, manufacturer specified earthing recommendations shall be followed for all communicating equipment connected to SCADA. This includes but is not limited to SMBs, Inverters, WMS and Switchgear panels.

15.6 Communication Cable Laying

15.6.1 All RS485, IO and CAT6 cables shall be laid in separate conduits with a minimum separation of 1.5ft from AC/DC power cables all along.

15.6.2 Power cables shall be laid deep in the trenches first. Data cables shall be laid in separate conduits after partially filling the trenches to ensure minimum 1.5 ft separation between power and communication cables all along the trench.

15.6.3 IO Cables between switch gear panels and SCADA panel shall be laid on separate cable trays, with a minimum of 1.5ft separation from trays carrying AC Power cables.

15.6.4 RS485 & CAT6 cables between switch gear panels or Inverters and SCADA panel shall be laid on separate cable trays, with a minimum of 1.5ft separation from trays carrying AC Power cables.

15.7 Control Cabinets / Panels / Desks at Main Control Room

15.7.1 The cabinets shall be IP 22 protection class. The Contractor shall ensure that the temperature rise is well within the safe limits for system components even under the worst condition and specification requirements for remote I/O cabinets.

15.7.2 The cabinets shall be totally enclosed, free standing type and shall be constructed with minimum 2 mm thick steel plate frame and 1.6 mm thick CRCA steel sheet or as per suppl'er's standard practice for similar applications.

15.8 Software Licences



The Contractor shall provide software license for all software being used in Contractor's System. The software licenses shall be provided for the project and shall not be hardware/ machine-specific.

15.9 Hardware at Main Control Room

15.9.1 The Hardware as specified shall be based on latest state of the art Workstations and Servers and technology suitable for industrial application & power plant environment.

15.9.2 The Local Monitoring & Control Server and the Operating Work station, to be deployed in the Plant Control Room, shall have the following server hardware and operating system along with accessories:

Plant Server	
Server Hardware	Hex/Octal Core Xeon, 32GB RAM (expandable to 64 GB RAM), 4 X 2TB SATA hard discs in RAID 5 configuration, 2TB external USB hard disc (for backup), dual power supplies, 2 LAN ports, LCD console, keyboard & mouse. The Server hardware shall be housed in a rugged fan-cooled, and rodent-proof Server Rack.
Operating System	Operating System and Database shall be of enterprise scal56referably RedHat Linux or equivalent Linux OS, Oracle/MySQL or equivalent DB), with required AMC for 5 years.
Accessories	<ol style="list-style-type: none"> 1. Monitor: Min 22" LED Flat Monitor with non-interfaced refresh rate min. 75 Hz. 2. Keyboard: ASCII type 3. Pointing Device: Mouse 4. Intelligent UPS (on line): Minimum 2 hour battery backup.
Operator Workstation	
Hardware	i7 CPU running at 3.0 GHz or faster with 8GB RAM, 500GB hard disk, 25" LED monitor, keyboard and mouse, 4 USB ports, LAN port
Operating System	Windows operating system with necessary tools, anti-virus software.
Accessories	<ol style="list-style-type: none"> 1. Screen Display Unit: Min 50" LED Flat Monitor with wall mounted arrangement for the display of SCADA screen 2. A4 size monochrome laser printer. 3. UPS of required capacity with 2 hour battery backup.



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15.9.3 All network components of LAN and Workstations shall be compatible to the LAN, without degrading its performance.

15.10 Factory Acceptance Test (FAT)

FAT procedure shall be submitted by bidder for approval. SCADA shall communicate with all third devices which are part of solar plant and same shall be demonstrated during the FAT.

16 **Illumination**

16.1 Standards and Codes

LED luminaires shall be tested at independent laboratory as per the following test standards.

Standard/Code	Description
LM79-08	Electrical and Photometric Measurements of Solid-State Lighting Products
LM 80-15	Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays and Modules

16.2 General specification

16.2.1 This specification covers design, supply and installation of uniformly Illumination system along the peripheral & internal roads, main control room & inverter rooms, switchyard and other facilities including entry points/gate(s) inside the plant area.

16.2.2 The Contractor shall furnish Guaranteed Technical Particulars of the LED luminaires, from renowned brands available in the market for approval of Employer.

16.2.3 Lighting system shall work on the auxiliary supply and same shall be incorporated in auxiliary loads. The Contractor shall provide minimum 20% of total lighting points as emergency lighting points, fed from UPS DB or DCDB as per scheme adopted by the Contractor. Indoor and outdoor emergency lights shall be provided at each inverter room, main control room, security room and main gate.

16.3 Lighting Levels

16.3.1 The average LUX level of 10 lumen is to be maintained in switchyard. However, a lux level of 20 lumen ((10+10) additional switchable on requirement only) is to be maintained in switchyard on transformer.

16.3.2 The lighting system for outdoor and indoor areas of solar power plant shall be designed in such a way that uniform illumination is achieved. Average LUX level to be maintained in different areas shall be as under:



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Area	LUX
Control Room and equipment rooms	300
Office	300
Battery & other rooms	150
Internal road	4
Transformer yard / Switchyard	20
H – pole and metering point	10

- 16.3.3 The lighting level shall take into account appropriate light output ratio of luminaires, coefficient of utilization maintenance factor (of 0.7 or less) to take into account deterioration with time and dust deposition and illuminance uniformity [Uo] shall be min 0.3.
- 16.3.4 Plant boundary/ Peripheral area shall be illuminated with chain-link/Boundary wall post mounted LED floodlights (at every 100m) for area lighting as per following specifications:

Parameter	Specified Value
Input Voltage	220 – 240 V AC
Frequency	50 Hz – 60 Hz
LED Power Consumption	50 W
LED Luminous Efficiency	85 lumen / W
LED Luminous Flux	4500 lumen
Lamp Efficiency	> 88 %
Colour Temperature	Cool White
Colour Rendering Index	> 75
Light Distribution	Symmetric / circular spot
Light Design	LED + Reflector
LED Junction Temperature	≤ 80°C
Working Temperature	-40°C – 55°C
IP Grade	IP 65
Mechanical Strength	IK 08



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Working Life Span	30000 Hrs
Certification	CE & ROHS
Warranty	3 Years Product Replacement

16.4 LED Luminaire for Outdoor Applications (Other than Peripheral Area)

16.4.1 LED luminaires shall meet the following parameters.

Parameter	Specified Value
Input voltage	170 - 260 V
Input Frequency	50 Hz +/- 1 Hz
Power Factor	0.90 (Minimum)
Luminaire efficacy	> 90 lumens per watt
Beam Angle	Minimum 120°
Total Harmonic Distortion	< 10 %
Working Humidity	10% - 90% RH (Preferably Hermetically sealed unit)
Degree of Protection	Minimum IP 65 (for Outdoor fixtures)
Luminaire Casing	Powder coated metal / Aluminium.
Colour Temperature	5700 K (cool day light)
Colour Rendering Index	> 65
Moisture protection in case of casing damage	IP 65 (driver unit shall preferably be totally encapsulated)

16.4.2 The LED luminaire (outdoor) housing, heat sink, pole mounting bracket, individual LED reflectors and front heat resistant tempered glass should be provided.

16.4.3 The LED luminaire (outdoor) housing should be made of non-corrosive, high-pressure, die-cast aluminium and the housing should be power coated grey, so as to ensure good weatherability. Each individual LED source should be provided with an asymmetrical distribution high reflectance aluminized reflector, which should ensure that the light distribution of the luminaire is suitable for road lighting applications (wide beam distribution) and should ensure high pole to pole spacing.

16.4.4 The luminaire should be provided with in-built power unit and electronic driver.

16.4.5 The luminaire should be suitable for standard street light poles and should be suitable for side entry and bottom entry (post top).

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- 16.4.6 GI Lighting pole of suitable diameter capable of withstanding system and wind load, shall be provided with average Zn coating thickness of 80micron. The street light poles shall have loop in loop out arrangement for cable entry and light fixture / wiring protected with suitably rated MCB.
- 16.4.7 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.
- 16.4.8 Lighting panels shall be earthed by two separate and distinct connections with earthing system. Switch boxes, junction boxes, lighting fixtures, etc. shall be earthed by means of separate earth continuity conductor. Cable armour shall be connected to earthing system at both the ends. Proper earthing of street light poles shall be ensured.
- 16.4.9 Junction box for lighting shall be made of fire-retardant material. The degree of protection shall be IP 55 for outdoor JB.
- 16.4.10 Lighting cables, wherever exposed to direct sunlight, shall be laid through Double Wall Corrugated (DWC) HDPE conduits.

16.5 LED Luminaire/Lamps for Indoor Applications

- 16.5.1 LED luminaire/lamps shall have minimum 3-star BEE rating.
- 16.5.2 All indoor LED luminaire/lamps shall be supplied with proper diffuser to avoid direct visibility of LED and suitable heat sink for longer life.

16.6 Warranty

All luminaires shall be warranted against all material/manufacturing defects and workmanship for minimum of 2 (two) years from the date of supply.

17 Weather Monitoring System

As a part of weather monitoring system, the Contractor shall provide the following measuring instruments with all necessary software and hardware required to integrate with SCADA.

17.1 Pyranometer

- 17.1.1 The Contractor shall provide Class-A pyranometers (ISO 9060:2018 classification) along with necessary accessories for measuring incidental solar radiation at horizontal and inclined plane of array.
- 17.1.2 Specification of the pyranometer shall be as follows.

Parameter	Specification
Spectral Response (50% points)	0.31 to 2.8 micron

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Operating temperature range	0°C to +80°C
Ingress Protection	IP 67
Resolution	Minimum +/- 1W/m ²
Output	Analog output: 4 – 20 mA Serial output: RS485

- 17.1.3 Each instrument shall be supplied with necessary cables. Calibration certificate with calibration 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. The Contractor shall provide instrument manual in hard and soft form.

17.2 Temperature Sensor

The Contractor shall provide minimum 3 (three) temperature sensors (1 (one) for ambient temperature measurement with shielding case and 2 (two) for module temperature measurement) at each site. The temperature sensor shall be Resistance Temperature Detector (RTD)/ Semiconductor type with measurement range of 0°C to 80°C. The instrument shall have valid calibration certificate.

17.3 Anemometer

Contractor shall provide minimum one no. ultrasonic wind sensor (no moving parts) for wind speed and direction monitoring.

Parameter	Specification
Velocity range with accuracy limit	0-60m/s with +/-2% accuracy @12 m/s; Resolution: 0.01m/s
Wind direction range with accuracy limit	0 to 360° (No dead band) with +/-2° accuracy @12 m/s; Resolution: 1°
Mounting Bracket	Anodized Aluminium bracket to reduce corrosion, all mounting bolts of SS
Protection Class	IP 66
Output	RS 485

17.4 Data logger and Data Acquisition System

Data logger for the weather monitoring station should have the following features:

- 17.4.1 Provision for analog, digital and counter type inputs for interfacing with various type of sensors
- (i) Analog Input

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- Adequate nos. for all analog sensors with redundancy
 - Provision for operation in different current and voltage ranges as per connected sensors
 - Accuracy of $\pm 0.1\%$ of FS
- (ii) Digital Inputs
- Adequate no. of Digital inputs and outputs for the application
- (iii) Provision for RS232 and RS485 serial outputs
- (iv) Built-in battery backup
- (v) Connectivity and Data transmission:
- RS485 MODBUS interface for data collection and storage on SCADA
 - Communication protocol should support fast data transmission rates, enable operation in different Frequency bands and have an encryption-based data security layer for secure data transmission
- (vi) Display Settings: Graphic LCD screen which should be easily accessible and should display relevant details like all sensor values, battery strength, network strength etc.
- (vii) Provision of Time synchronization from telecom time or server time
- (viii) Data Storage: Provision for at least 2 MB internal Flash Memory and at least 8 GB Micro SD card (expandable)
- (ix) Protection level: IP 65

18 CCTV Camera

18.1 CCTV Cameras along with monitoring stations (sufficient numbers) and all other accessories required for its proper operation must be installed to have complete coverage of following areas for 24 hours.

- (i) Main entry: Covering all the entry/exit
- (ii) Along the Plant Perimeter: Covering complete perimeter of Plant Area to capture all possible intrusion
- (iii) Control Rooms: Covering Entry/Exit and Equipment Rooms
- (iv) Switchyard

18.2 Monitoring stations of the CCTV Network shall be installed in Main Control Room.

18.3 The CCTV system shall be designed as a standalone IP based network architecture. System shall use video signals from different cameras at defined locations, process the



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video signals for viewing on monitors at control room and simultaneously record all video streams using latest compression techniques.

- 18.4 Camera shall be colour, suitable for day and night surveillance (even under complete darkness) and network compatible.
- 18.5 It shall be possible to control all cameras i.e., PTZ auto/ manual focus, selection of pre-sets, video tour selection etc. The software shall support flexible 1/2/4 windows split screen display mode or scroll mode on the display monitor for live video.
- 18.6 The system shall support video analytics in respect of the following:
- (i) Video motion detection
 - (ii) Object tracking
 - (iii) Object classification
 - (iv) Camera server shall be provided with sufficient storage space to storage recordings of all cameras at HD mode for a period of 15 days. All recordings shall have camera ID, location, date and time of recording.

19 Fire Alarm System

19.1 Standards and Codes

Standard/Code	Description
IS 2189	Selection, Installation and Maintenance of Automatic Fire Detection and Alarm System Code of Practice
IS 2171	Portable Fire Extinguishers, Dry Powder (Cartridge Type)
IS 8149	Functional requirements for twin CO ₂ fire extinguishers (trolley mounted)
IS 2546	Galvanized mild steel fire bucket
National Building code 2016	

- 19.2 Contractor shall ensure the compliance of fire detection and alarm system as per relevant standards and regulations. The installation shall meet all applicable statutory requirements and safety regulations of state/central fire department/body or any other competent authority in terms of fire protection.
- 19.3 Firefighting system for the proposed power plant for fire protection shall be consisting of but not limited to:
- (i) Sand buckets
 - (ii) Portable fire extinguishers (CO₂ and dry powder type)
 - (iii) Microprocessor based fire alarm panel
 - (iv) Multi sensor smoke detectors



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- (v) Hooter cum strobe
- (vi) Manual call points
- (vii) Cables from sensor to fire Panel.

- 19.4 Minimum two numbers of fire extinguishers (CO₂ and Foam type each, of capacity 9 kg having BIS certification marking as per IS: 2171) shall be provided at every building/ enclosure, transformer yard and switchyard. However, contractor must comply with existing building code for fire protection and relevant IS codes.
- 19.5 Four numbers of stand with four sand buckets on each stand shall be provided in the Transformer Yard. Sand buckets inside the building shall be provided at strategic locations as decided during detailed engineering.
- 19.6 Digital output from the fire detection system shall be integrated with SCADA
- 19.7 Contractor shall submit the plan for fire and smoke detection system for the Employer's approval.

20 Testing Instruments

The Contractor shall provide the following set of instruments for on-site testing.

20.1 Earth resistance tester

Parameter	Specification
Display	Backlit LCD or LED display
Range	Earth Resistance: up to 2000 Ω Earth Voltage: 200 V
Accuracy	± (2% + 5)
Safety Ratings	IP 56
Programmable Limits setting	Enabled
Accessories	
Earth Ground Stakes – 4 Nos.	
Cable Reels – 3 Nos.	
Battery - 2 set	
Carry Case with sufficient space for accommodating accessories	

20.2 Array tester

Parameter	Specification
Display	Backlit LCD or LED display



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Functionality	All electrical tests required by IEC 62446-1:2016
Memory	Up to 200 records & USB downloadable to Computer
Accessories	
A set of two, 4mm fused leads for extra protection during installation tests.	
Leads which enable the array tester to connect directly to PV arrays	
Battery - 2 set	
Carry Case with sufficient space for accommodating accessories	

20.3 Insulation tester

Parameter	Specification
Display	Backlit LCD or LED display
Insulation Test Range	0.1 MΩ to 10 GΩ
Test Voltage	250V, 500V, 1000V, 5000V
Test Voltage accuracy	+20% on positive side only no negative variation is allowed
Accessories	
Heavy duty Test Leads with Alligator Clips - 1 set	
Battery - 2 set	
Carry Case with sufficient space for accommodating accessories	

20.4 Digital Multimeter

Parameter	Specification
Voltage Range	1500 V DC / 1000 V AC (True RMS)
Display	4 ½ digits, Backlit LCD or LED
Measuring Category	1000 V CAT III as per IEC Standard 61010-1
Additional Functions	Resistance, Temperature, Continuity, Diode, Capacitance, Frequency, Duty cycle measurement
Accessories	
Temperature Probe – 1	
Test Leads with Alligator Clips - 1 set	
Battery – 2 set	



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Carry Case with sufficient space for accommodating accessories

20.5 Clamp meter

Parameter	Specification
Current Range	400 A DC / 1000 A AC (True RMS)
Display	Backlit LCD or LED display
Measuring Category	1000V CAT III as per IEC 61010-1
Additional Functions	Active, Reactive and Apparent Power, THD, PF
Accessories	
Test Leads - 1 set	
Battery – 2 set	
Carry Case with sufficient space for accommodating accessories.	

20.6 Infra-red thermal imaging camera

Parameter	Specification
Spectral response	8 μ m to 14 μ m (LW)
Temperature-sensitivity and calibration range	-20 °C to +120 °C
Atmospheric air temperature	-10 °C to +40 °C
Thermal sensitivity	NETD \leq 0.1 K at 30 °C
Geometric resolution	640 x 480 pixels
Absolute error of measurement	$< \pm 2$ K
Adjustable parameters	Emissivity, Reflected temperature
Adjustable functions	Focus, temperature level and span
Measurement functions	Measuring spot, measuring area with average and maximum temperature
Calibration	The measuring system (Camera, lens, aperture and filter): The thermographic camera has to be traceably calibrated at least every two years. The calibration has to be documented. If the camera is not compliant (absolute temperature and/or temperature differences), it has to be readjusted by the manufacturer.



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Documentation	Storing of the infrared picture with the radiometric data to be able to determine absolute temperatures
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20.7 Digital lux meter

Parameter	Specification
Range	0 – 1000 lux
Accuracy	± (2% + 5)
Resolution	1 lux
Display	3½ digits, Backlit LCD/LED
Accessories	
Battery – 2 set	
Carry Case with sufficient space for accommodating accessories.	

20.8 All testing equipment shall possess valid calibration certificate issued from approved NABL labs.

20.9 Instruments of superior rating is allowed after seeking consent of the Employer.

20.10 Maintenance, calibration, up keeping, repair & replacement of these tools will be in the scope of the Contractor during O&M.

20.11 It is Contractor's responsibility to arrange for tools, tackles, logistics, test kits, manpower, experts etc. required for trouble free operation of Plant.

21 Power Evacuation System

21.1 The Contractor has to do the power evacuation and integration to and with the designated substation via either overhead transmission line or underground cables at specified grid voltage with all necessary infrastructure such as protection switchgears and metering systems as per the requirement of the DISCOM/STU/Employer.

21.2 The Contractor shall get the route approval from the Employer prior to start of the construction. Any changes in the route or scheme due to ROW issues at any point of the time prior to commissioning shall be complied without any additional cost to the Employer.

21.3 The ROW for the TL/UG cable shall be obtained prior to the construction of the line from the concerned authorities.

21.4 While laying overhead line / underground cable, existing lines / cables shall not be disturbed. In case any damage is caused to the existing lines / cables, the Contractor shall repair / rectify the line / cable at his own cost.



21.5 Overhead Transmission Line

In case the power evacuation is planned with overhead transmission line for plant external evacuation, the design of tower and its accessories shall be as per the DISCOM / STU's requirement and the design shall be submitted to Employer for approval/ accord.

21.6 Underground cable

In case the power evacuation is planned with underground cable for plant internal evacuation, the cable shall be approved by the Employer. However, in case of external power evacuation, the evacuation plan shall be as per DISCOM / STU's requirement and the same shall be submitted to Employer for approval/ accord.

21.7 Insulators

21.7.1 Overhead Line shall have 22 kV Silicone Polymeric Composite insulators suitable for operation in the Site conditions and shall be designed to meet the high quality, safety and reliability capable of withstanding a wide range of environmental conditions.

21.7.2 The Polymeric Insulators shall consist of three parts, at least two of which are insulating parts: (a) Core – the internal insulating part (b) Housing – the external insulating part (c) Metal end fittings (dimensions as per IEC 60120 / IS 2486-2).

21.7.3 Tests

The Contractor shall furnish detailed type test reports as per IEC 61109 of the offered composite insulators from an NABL approved laboratory during detailed engineering. At least following type tests shall be conducted on a suitable number of individual insulator units, components, materials or complete strings.

- (i) Dry lightning impulse withstand voltage test
- (ii) Wet power frequency test
- (iii) Mechanical load-time test
- (iv) Radio interference test
- (v) Recovery of Hydrophobicity test
- (vi) Chemical composition test for silicon content
- (vii) Brittle fracture resistance test

These type tests should have been carried out within five years prior to the date of opening of the tender.

The following routine tests (as per IEC 61109) shall be applicable.

- (i) Identification of marking



- (ii) Visual Inspection
- (iii) Mechanical routine test

C Civil, Mechanical and Plumbing Works

1 General Requirement

- 1.1 This section of Technical Specifications describes detailed technical and functional requirements of all civil, structural, mechanical & plumbing works included in the scope.
- 1.2 This excludes design, supply and installation of Galvanised 220 kV and 132 kV Transmission Line towers, Tower extensions & accessories and 11 kV, 22 kV & 33 kV transmission poles & accessories which shall be designed following latest guidelines of respective SEB (State electricity board) and got approved from SEB/STU before execution. In absence of SEB/ STU guidelines, REC (Rural Electrification Corporation) standards shall be followed. Poles at corner with angle $> 10^\circ$ shall be provided with 4-pole structure or lattice tower. Use of Pre-stressed cement concrete spun poles is not acceptable. Approved copies of these designs & drawings shall be submitted to the employer for reference and record.
- 1.3 Standards & Codes
 - 1.3.1 All design and construction of civil works shall conform to relevant Indian standards such as BIS, IRC, MORTH, NBC etc.
 - 1.3.2 Design of steel structures shall conform to IS: 800, 801 or 802 as applicable. Design of concrete structures shall conform to IS: 456. For design of liquid retaining structure IS: 3370 shall be followed. Only in case of non-availability of Indian standard, equivalent American or British standard may be used for design with prior approval of the Engineer and the contractor shall submit proper justification for the same along with his request to the Engineer for review and approval, and the decision of the Engineer shall be final and binding.
 - 1.3.3 All the design/ drawings shall be prepared/ approved either by in-house Engineering Team of the contractor (or by his Engineering Consultant) with qualified engineering staff with relevant experience in successful design of solar SPV plants.
 - 1.3.4 The design calculations for MMS, RCC structure, Steel structure, Foundation system including piling, Road work, Drainage work, etc. shall be submitted for prior approval of Engineer before commencement of construction.
 - 1.3.5 As per project requirements, the Employer may ask for approval of all civil designs and drawings by a Chartered Civil/ Structural Engineer.



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- 1.4 The design calculations shall be supplemented with a neat sketch showing the structure geometry, node and member nos., lengths of various typical members, support points and type of supports, types of materials & type of sections with properties considered in analysis & design. The report shall also include back-up calculations for various loads adopted in design, brief write-up on primary load cases and design load combinations considered and conclusions on design results (with supporting sketches) for easy reference and clarity. Where a computer program (other than STAAD) is used for analysis and design, the contractor shall include a write-up on the computer program used along with examples for validation check. Design Input (format suitable to the programme used and also in STAAD format) and output file shall also be given in the design report and in soft copy to facilitate its review and approval by the Engineer.
- 1.5 The methodology for construction of MMS and its foundations, Road & drainage works and Procedure for pile load test shall also be submitted for prior approval of Engineer before start of these works.

2 Topographical Survey

- 2.1 The contractor shall be responsible for detailed Topographical Survey of the proposed project site. The work shall be carried out through an agency with relevant experience and qualified survey team.
- 2.2 The Topographical survey shall be conducted at 20m x 20m grid, or as directed by the Engineer, only with the help of Total Station only.
- 2.3 The Contractor shall carry the Bench Mark from nearest GTS Bench mark or any other established source like Railway station, Permanent PWD/ WRD structure etc. as approved by the Engineer, by fly-levelling and establish two permanent bench marks (PBM) at site. All subsequent transfer of levels shall be carried out with respect to these PBMs. The work shall also include constructing permanent reference pillars (RP) at suitable locations as directed by the Engineer. These reference pillars shall be labelled permanently with their respective coordinates and reduced levels for future use. The Permanent Bench Marks (PBM) and reference pillars (RP) shall be shown on the survey drawings.
- 2.4 While carrying bench mark to the project site, levels shall also be established on the permanent objects like culverts etc. at least on one object in every 1 (one) km if available along with route with adequate description about the objects. These levels shall be maintained at site & also mentioned in the survey report to facilitate locating



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these objects later on.

- 2.5 The survey work shall be carried out in UTM grid system. The contractor shall also establish the latitudes and longitudes and UTM coordinates of all the corners of the project site. At least 50m width of the adjoining plots and surrounding areas shall also be covered in the survey for correlation with adjoining plots and facilities. The grids for the survey work shall be established in N-S & E-W direction (corresponding to Geographical North or Plant North) as directed by the Engineer.
- 2.6 Positions, both in plan and elevation, of all natural and artificial features in the area like waterways, railway tracks, trees, cultivation, houses, fences, pucca and kutcha roads including culverts and crossings, foot tracks, other permanent objects like telephone posts and transmission towers etc. are to be established and subsequently shown on survey maps by means of conventional symbols (preferably symbols of survey of India Maps). All hills and valleys within the area/areas are to be surveyed and plotted on maps by contours. Any unusual condition or formation on the ground, locations of rock outcrops (if visible on the surface) and springs/falls, sand heap/dune, possible aggregate deposits etc. shall also be noted and plotted on contour maps. The C/L coordinates of existing road & cross drainage (CD) works (culverts etc.) at intermediate points & at corners/ intersections and width of carriage way of the road shall be recorded with their position on the contour maps.
- 2.7 The record of measurement of all Reduced Levels (RL) shall be submitted in digital format, (in x, y z coordinate system) along with preliminary contour plan of the site, for Engineer's review before submission of final contour map. The contour interval shall be as required for proper representation of the topography however it shall not be more than 0.5m. The Contractor shall submit survey maps of the site in 1:10,000 scale indicating grid lines and contour lines, demarcating all permanent features like roads, railways, waterways, buildings, power lines, natural streams, trees, sand dunes etc. Present use of the site i.e. mining, quarrying, agriculture etc., existing drainage pattern of the site, possibility of water logging and high flood level of the area shall also be captured in the document. The project plot boundary with coordinates of all corner points along with coordinate grid of 50m x 50m interval shall be marked on the contour map.

3 Geotechnical Investigations

- 3.1 Preliminary geotechnical investigations have been conducted by the Employer with 3 nos. of boreholes drilled at locations indicated in the location map attached with Soil



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Testing Report (Annexure – I). The soil at VOCPT site predominantly comprises of non-cohesive brown coloured sand with some clay contents at top layer. The water table was observed at shallow depth at the time of drilling the boreholes. The bore log data and lab test results on DS samples are attached in Annexure – I only for reference and general information of the bidder. No warranty is expressed or implied that such information, given in good faith, will represent a complete or accurate picture of the whole of the site. The Contractor shall be responsible for any inference it may draw from such information. Further, any recommendations regarding safe bearing capacity mentioned in the attached soil report shall not be entertained and the owner/SECI shall not take any responsibility of the same. Detailed Geotechnical investigations are in the scope of the bidder who is advised to inspect the site and study the nature of the soil before the submission of the bid. The Employer shall not be responsible for any variations in soil characteristics, if observed, during detailed soil investigation to be carried out by the Contractor during contract execution and there shall be no compensation what so ever in the contract price on this account.

- 3.2 The contractor shall be responsible for detailed Geotechnical investigations at the proposed project site for the purpose of foundation design for various buildings, structures, HT lines, MMS etc. and other design/ planning requirements. The investigation work shall be carried out through any Govt. approved/ NABL accredited agency. The contractor shall submit the credentials of the proposed agency along with relevant certificates in support thereof for verification/ approval of the Investigation Agency by the Engineer.
- 3.3 The scope of work includes execution of complete soil exploration including boring and drilling with rotary drilling rig, standard penetration test (SPT), collecting disturbed (DS) and undisturbed samples (UDS), collecting ground water samples, trial pits, electrical resistivity tests (ERT), field & laboratory CBR tests, conducting laboratory tests on collected samples of soil & ground water and preparation and submission of report. SPT shall be carried out in all types of soil deposits and in all rock formations with core recovery up to 20% met within a borehole (BH). SPT test shall be conducted at every 1.5m interval or at change of strata. The starting depth of SPT shall be 0.5m from ground level. UDS shall be collected at every 1.5m interval or at change of strata. The min. size of trial pit shall be 2.0mx2.0mx2.5m deep.
- 3.4 The field investigations shall mainly include drilling of min. 5 m deep BHs (with min. 2 no. of boreholes to be 10m deep), conducting SPT and collecting Disturbed (DS) and



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Undisturbed samples (UDS), conducting in-situ CBR test for approach road to the plant, internal roads & peripheral road; Trial pits (TP) and Electrical resistivity tests (ERT). Number and location of BHs, California bearing ratio (CBR) tests, ERTs and TPs shall be decided as per the project layout, site topography and soil conditions in consultation with the Employer. The proposed locations shall fairly represent the total project site to get the complete required geotechnical information. The BH near MCR and ICR shall be 10m deep. There shall be minimum 1 nos. of BH per 10 acres of the area (However, total number of boreholes shall not be less than 5), 3 nos. of Trial pits, 5 nos. of CBR test & ERT, 5 nos. of Ground water samples for laboratory investigations. The soil/ rock samples for laboratory investigations shall be collected from each borehole and trial pit in sufficient nos. (Note- In case the project plot is divided in to number of discrete blocks separated from each other, min. 3 nos. of bore holes, 2 trial pits, 2 ERT and 2 CBR tests shall be taken per such block with at least 1 No. of BHs per 5 acres as specified above).

- 3.5 The proposed Geotechnical investigation plan indicating proposed locations of TPs, BHs, water sample collection points, CBR test & ERT shall be submitted to the Employer for review and approval before start of work.
- 3.6 Laboratory tests shall be conducted on DS & UDS samples and ground water samples in sufficient no. & shall include, Soil classification, Grain size analysis including Hydrometer analysis, determination of Bulk and dry density, Specific gravity, Natural moisture content, Atterberg limits, Tri-axial shear tests (Unconsolidated Undrained – UU) on UDS, Undrained shear test, Consolidation tests, Unconfined compression tests (UCS), Free swell index, chemical analysis of soil and water samples to determine the carbonates, sulphates, chlorides, nitrates, pH, Organic matter and any other chemicals harmful to concrete and reinforcement/ steel. Laboratory tests on rock samples shall be carried out for Hardness, Specific Gravity, Unit Weight, Uniaxial Compressive Strength (in-situ & saturated), permeability test (in-situ, to be conducted at a depth of 750 mm), Slake Durability etc. Laboratory CBR test on soaked samples shall also be conducted on min. 5 no. of soil samples to ascertain the suitability of soil for sub-grade and requirement of any treatment of subgrade soil in case of CBR <2% as per IRC requirements.
- 3.7 After completion of field and laboratory work, the contractor shall submit a Geotechnical Investigation Report for Engineer's approval. All bore log details and lab test results shall be presented in the report as per provisions of relevant BIS standards indicating



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BH coordinates, Existing GL, Depth of water table, Method of drilling etc. The report shall include a Map showing the locations of various field tests including coordinates, calculations and recommendations for foundation type and safe bearing capacity (SBC) for various Plant buildings (ICR, MCR etc.) and Open installations, Switch Yard structures & Sub-Station (as applicable), Transformer foundation, HT lines (as applicable), MMS foundation etc. corresponding to settlement of 25mm.

- 3.8 The report shall include the study for “Liquefaction potential assessment of the ground and suggestions for any ground improvement measures” as required.
- 3.9 The report shall also include ground water analysis (water sample collected from bore well) to ascertain its suitability for construction purposes, recommendations for type of cement, grade of concrete & minimum cement content as per prevalent soil characteristics with respect to presence of aggressive chemicals and environment exposure conditions as per relevant BIS specifications. However, minimum grade of concrete shall be as specified under Cl.13.0 ‘Concrete Works’.
- 3.10 All buildings and Plinth for Open installations (MCR, ICR etc.), Transformer yard, Switchyard and Sub-station area shall have levelled ground as detailed under Cl. No. 5 below.

4 Other Investigations

- 4.1 The contractor shall also obtain and study other input data at proposed project site for design of the project from metrological department/ local govt. authorities. This shall include data related to Rainfall, Maximum & Minimum ambient Temperature, Humidity, HFL etc.
- 4.2 The contractor shall carry out Shadow Analysis at proposed site and accordingly design strings and array layout with optimum use of space, material and man power. In case of large variations in topography (3° to the horizontal) the study shall also include the effect of topographical variations on array layout and MMS structure design adequacy and stability. The contractor shall submit all the details/ design to the Engineer for review/ approval.
- 4.3 The contractor shall also identify potential quarry areas for coarse and fine aggregates to be used for concrete and shall carry out the concrete mix design for concrete grades to be used in construction of all concrete works (M25 and above) before start of construction. However, for piling M25 concrete with nominal mix of (1:1:2) may be used. For grades of concrete less than M25 to be used in PPC works, nominal mix as specified in IS:456 may be used. The concrete mix shall be designed for each source



of cement and aggregates as per provisions of IS:10262 and confirmed through 28 days compressive strength of concrete trial mix samples. Target mean strength of concrete for mix design shall be based on σ (standard deviation) = 5. The concrete mix design shall be carried out through NABL accredited Laboratory or any Govt. agency approved by the Engineer. In case the contractor proposes to use RMC, the same shall conform to IS: 4926. The Contractor shall submit the Concrete mix design proposed to be used by the RMC for review and approval by the Employer. (Reports of periodic quality tests for the supply concrete batch shall be maintained by the RMC supplier as per approved Quality Plan and the same shall be submitted to the Employer for review and record).

5 Area Grading and Land Development

- 5.1 The Finished Grade Level (FGL) of the proposed plant shall be fixed with reference to the highest flood level (HFL) and surrounding ground profile at proposed site to avoid flooding of plant site. The data regarding HFL at proposed site shall be obtained from the metrological department by the contractor. In case of absence of this data, the contractor shall assess the required information through local site reconnaissance. The area at and around (up to 25m beyond external wall/ area including access road & parking whichever is minimum) all buildings/ plinth for open installations (ICR, MCR etc.), transformer yard and switch-yard shall be uniformly levelled at suitable RL (i.e. FGL) to be finalized considering topography and HFL at site. The minimum plinth level of all buildings/ open installations shall be 1000mm above FGL. Module mounting structure foundation/ Pile cap or any other pedestal shall be min. 200mm above FGL. Top of transformer foundation pedestal shall be min, 500mm above the FGL.
- 5.2 A detailed drawing for site levelling and grading (if necessary) shall be submitted by the contractor before commencement of construction of all buildings, plinth for open installation and transformer/switchyard works. The estimated volume of cutting and filling shall also be marked on the Grading drawings for reference. The final grade levels to be adopted for different blocks shall be clearly marked on the Plant Layout/ Array Layout drawing.
- 5.3 It is envisaged that the MMS are installed on natural/ existing ground without any levelling or grading of the area. Contractor shall accordingly consider the effect of the existing ground slope on the design of MMS structure as specified elsewhere in the specifications. If any ground undulations at column locations are observed the same shall be filled up with PCC (1:3:6) up to surrounding ground level immediately after pile



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installation before start of erection of other MMS members. In case of pile, the PCC fill shall extend min. 500mm outside pile cap all around and remaining area may be filled up with local soil properly compacted.

- 5.4 The contractor is responsible for making the site ready and easily approachable by clearing bushes, felling of trees (mandatory permissions/ licenses/ statutory clearances from competent authorities if required for cutting of trees, blasting or mining operations, disposal of waste material etc. shall be obtained by the contractor), cutting, filling with selected excavated earth or borrowed earth including identifying borrow areas. Except in exceptional cases (with approval of the Engineer), filling shall be made up of cohesive non-swelling material. The filling for levelling/ reclaiming the ground/ area shall be done in layers not more than 150mm of compacted thickness in case of cohesive (clayey) soils and 250mm compacted thickness in case of granular (sandy) soils with compaction up to 95% (of modified proctor density) and 80% (of relative density) respectively. The slope at edge of graded areas shall not be steeper than 1:1.5 (1 Vertical: 1.5 Horizontal) in cutting and 1:2 (1 Vertical: 2 Horizontal) in filling. In case of filling with rock material, the edges shall be provided in line with provisions of relevant BIS standard.
- 5.5 It shall be ensured that the land grading and levelling is done properly to ensure for free flow of surface run-off and the grade levels shall be fixed with respect to high flood level at site, drainage pattern and system requirements. It shall be ensured that the land is used optimally to have maximum solar power generation considering full utilization of the plot areas. It is advisable to follow the natural flow of water at the ground as far as possible for drainage design.
- 5.6 In case the filled up earth is brought from outside the plant or borrow areas (when the material inside plant area is not found suitable for grading work or if directed by the Engineer), the contractor shall carry out all required soil investigations to ascertain the suitability of the borrowed soil for land development and filling purposes. Contractor's scope shall also include arranging land lease, getting all necessary statutory approvals for mining, payment of necessary challan etc. Excess earth, if any, shall be disposed of properly at location as directed by the Engineer.

6 Roads

- 6.1 Suitable approach road (as applicable) from nearest public road up to plant Main gate, Access road from Main gate to Main control cum office room (MCR), Internal roads connecting MCR and other facilities/ buildings/ open installations like Local control



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room(s) (LCR)/ Inverter control room(s) (ICR), Sub-station & Switch yard (as applicable) etc. shall be provided for safe and easy transportation of men, material and equipment during construction and maintenance.

- 6.2 The approach road connecting nearest public road and the Main gate shall be of 4.0m wide carriage way with 0.5m wide shoulders on either side. The access road connecting Main gate and MCR and internal access road(s) connecting MCR to various facilities/ buildings/ open Installations shall be of 3.0m wide carriage way with 0.5m wide shoulders on either side. The top of road (TOR) elevation shall be minimum 200 mm above FGL to avoid flooding of roads during rains. The roads shall be provided with alongside drains as per design requirements of drainage system for effective disposal of storm water and to avoid cross flow of storm water over the road. The roads shall be designed as per IRC SP-72 corresponding to traffic category T1 and critical field CBR value of the subgrade.
- 6.3 However, following minimum road section details shall be followed:
- (i) Topping: 75 mm thick PCC (1:2:4)
 - (ii) Base course WBM (CBR>100%) conforming to Cl. 405 of MORD specs: 125mm compacted thick, Grade III
 - (iii) Base course WBM (CBR>100%) conforming to Cl. 405 of MORD specs: 125 mm compacted thick, Grade II
 - (iv) Granular/ gravel sub-base course (CBR>20%), conforming to Cl. 401 of MORD specs: 350 mm compacted thick, compacted to 98% of max dry density
 - (v) Compacted subgrade: 300mm thick below sub-base (non-expansive soil with max. dry density > 1.65 kN/m³) conforming to Cl 303 of MORD specs, compacted up to 98% of standard proctor density in layers of 150mm thickness. In case of expansive soils like black cotton soil suitable treatment as per Cl. 403 of MORD specs shall be provided before laying sub-base course.
 - (vi) Shoulders: 150mm compacted thick, murrum blended with WBM Grade-III
- 6.4 Soaked CBR value of sub-grade shall not be less than 2%. Where the CBR of the subgrade is less than 2 % a capping layer of 100 mm thickness of material with a minimum CBR of 10 % is to be provided in addition to the sub-base required for CBR of 2 %. When the subgrade is silty or clayey soil and the annual rainfall of the area is more than 1000 mm, a drainage layer of 100 mm over the entire formation width should be provided conforming to the gradation given in Chapter 6 of IRC SP-20. This layer will form a part of the designed thickness of sub-base.



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- 6.5 In case of no-availability of murrum in the nearby areas of the project site, suitable other screening/ blending material for WBM construction may be used conforming to provisions of IRC SP 20.
- 6.6 The construction of road shall conform to MORD specifications for Rural roads published by IRC.
- 6.7 Drain, cable or any other crossing shall be provided with RCC box or precast concrete pipe culvert. The culvert design shall conform to relevant IRC standard. The pipes for road culverts shall be of minimum class NP3 conforming to IS 458 with min. soil cover of 750mm above the pipe. In case of soil cushion less than 750mm the pipe shall be provided with 100 mm thick M20 reinforced concrete encasement with 10 dia. reinforcement rods @ 150mm c/c both ways. However, the water supply pipe for module cleaning and service/ drinking water shall be routed through Medium class GI steel pipe of required dia. conforming to IS: 1161.
- 6.8 Minimum dia. of casing pipe to be used at any facility like electric cable, water pipe line etc. shall be 150mm.
- 6.9 Maintenance pathways of min. 1.0m width shall be provided between SPV arrays for easy movement of maintenance staff, tools, equipment and machinery, washing of modules etc. The pathway area shall be generally levelled and well compacted manually/ mechanically. Areas of depression, valley zones or wherever there is noticeable change in topography, shall be levelled using well compacted good earth matching the top finished surface with ground topography/ grade to avoid accumulation of water in the region and allowing its free flow to keep the area devoid of mud/ sludge.
- 6.10 There shall be no peripheral road. However, about 2.5m wide corridor compacted to a depth of 300mm shall be left along inside of the plant boundary suitably maintained clean of any vegetation and shall be provided with adequate illumination for movement of security personnel. Any undulations shall be made good with locally available coarse grained material to have fairly level passage way.
- 6.11 The design and drawings for approach road, all internal roads and culverts shall be submitted to the Engineer for approval before execution.

7 Surface/ Area drainage

- 7.1 The contractor shall design and construct storm water drainage network for smooth disposal of storm water from the plant to the nearest available drainage outlet.
- 7.2 The storm water drainage system shall be designed and planned to ensure no water stagnation in the plant.



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- 7.3 The plant drainage system shall be designed for the design rainfall intensity obtained by hourly rainfall intensity of 92 mm/hour converted to the design duration equal to the relevant time of concentration as IRC SP 42.
- 7.4 The design shall conform to the provisions of IRC SP 42 and best Industry practices.
- 7.5 The coefficient of run-off for estimation of design discharge shall be considered as per catchment characteristics, however it shall not be less than 0.6.
- 7.6 The drainage scheme shall be designed considering the plant plot area and the surrounding catchment area contributing to the plant area drainage as per the topography.
- 7.7 The storm water drainage system shall be a network of open surface drains (with rectangular or trapezoidal cross section) and shall generally be designed to follow the natural flow of water and ground contours.
- 7.8 Suitable size plant peripheral drain as per design and requirement (min. 450mm bottom width x 450mm depth) along inside of plant boundary wall/ fence shall be provided for smooth channelization of outside storm water and to avoid flooding in the plant. The peripheral drain shall have trapezoidal cross section and shall be lined with min. 100 mm thick stone pitching. All trapezoidal drains shall have side slopes not steeper than 1:1. The size of all internal and road side drains shall not be less than 300mm (bottom width) x 300mm (depth).
- 7.9 Internal drains may be provided unlined depending upon the geotechnical characteristics and drainage design in the view of the stability and erosion of drain walls. However, the drain segments near outfalls and drain crossings shall be lined with either RR masonry or concrete or stone slabs as suitable to the site conditions. The minimum thickness of the lining shall be 75mm for concrete slabs, 100mm for RR masonry and 50mm for stone slabs. All drain lining shall be in CM (1:4) and the joints shall be raked and pointed with CM (1:3), however the joints in lining of plant peripheral drain may be left without pointing.
- 7.10 In case of rectangular drain, the thickness of the wall shall be checked against structural stability under action of the design loads as specified in Cl. No. 10.0 'Design Loads'. However, the min. wall thickness shall be 200mm and 100mm respectively for RR masonry and RCC work.
- 7.11 The slopes of the existing drains (on side of Gulf of Mannar and near the Bus stop end of the project) shall be stabilized by flattening the existing slope to 20° and protected against erosion by providing dry stone pitching of min. 300 mm thickness. Suitable



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intermediate surface drains shall be provided to facilitate flow of rain water over the slope in to the drain. If required, as per soil conditions, a layer of geotextile may be laid below the stone pitching for protection of soil against erosion.

- 7.12 The structural design of drains shall be as per provisions of relevant BIS standards and good industry practice.
- 7.13 The drain outfall shall be connected to the nearest existing natural drain(s)/ water body outside plant premises and it shall be ensured that the drainage water shall not re-enter the plant nor encroach/ flood in the adjacent property/ plot.
- 7.14 The proposed drainage scheme along with design calculations and drawings shall be submitted to the Engineer for review/ approval before start of construction.
- 7.15 The contractor shall provide percolation/recharge pit for harvesting of water in the MCR area. For the remaining plant facilities, the Contractor shall explore provisions for rain water harvesting system for water conservation by constructing suitable collection wells along the drains or through provision of detention ponds or percolation/recharge pit etc. at major drainage outfalls. The scheme for rain water harvesting along with design calculations shall be submitted for approval.

8 Peripheral Chain Link Fence

- 8.1 The plant peripheral boundary shall be provided with chain link fencing.
- 8.2 The boundary fence shall be provided along the Solar PV plant boundary to demarcate the plant boundary and to keep away the unauthorised access to the plant. The fence shall be provided with Main entry gate. The fencing shall be with 2.5m height above grade level including 400mm dia. GI concertina wire along with 3 no. of barbed wires on either arm to be fixed on Y shape angle brackets. The main gate shall be min. 5m wide (clear) with 1.5m wicket gate as per tender drawing.

8.3 Chain link fencing

- 8.3.1 The fencing shall be of Chain link (poly coat GI) mesh fabric with internal, corner and stay posts of RCC (min 200mm x 200mm size, M30 grade) with 100mm thick M15 PCC foundation (min. width 450mm and min. depth 450 mm below GL).
- 8.3.2 Intermediate, corner and stay posts shall be supported with min. 300 mm dia. and 850 mm deep (below GL) piles in cement concrete (nominal mix 1:1:2). The column posts shall be extended in to the pile up to 800mm with 50mm cover at the bottom. The pile shall project 150mm above GL. The intermediate, corner and stay posts shall be supported by angle struts that shall have the same foundation as that of the main



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posts.

8.3.3 Void

8.3.4 Spacing of intermediate posts shall not be more than 2.5m. Every 10th intermediate post shall be provided with a stay post while every corner post shall be provided with two stay posts on either side.

8.3.5 Joints in RR masonry shall be properly raked and pointed with CM (1:3).

8.3.6 In case of pond/ drain crossing the fence, RCC beam of adequate size supported on RCC columns on either side and suitable grill of MS square rods (vertical spacing not more than 150mm) of min. Size 25x25 mm and min. 3 no. horizontal 20 SQ MS rods or 50 mm x 8 mm thick flats secured to RCC beam and columns; shall be provided in place of toe wall for smooth flow of water.

8.3.7 Poly coat GI chain link mesh (50x50mm) shall conform to ASTM 668 and fencing shall conform to ASTM 668.

8.3.8 Each fence panel, in lieu of tie wire, shall be provided with 35x35x3mm GI edge angle at top and bottom with mesh fabric firmly secured to them and to intermediate support angles.

8.3.9 All MS sections shall be painted with 2 coats of epoxy paint of approved make and shade over 2 coats of suitable primer.

8.4 VOID

8.5 VOID

8.6 Main Gate

Main Gate shall be provided as per the drawing titled 'Main Gate Drawing' attached under Annexure-F.

8.7 All design and drawings for peripheral boundary fence/ Wall and Main gate shall be submitted for Engineer's approval before execution.

9 Plant Layout

9.1 The contractor shall submit drawing showing proposed Project Plant and SPV module Layout.

9.2 The Plant and SPV module layout shall be a comprehensive drawing showing various requirements of the project like, Reference coordinate grid, Geographical and Plant North, Layout of boundary fence including coordinates of all corner points, Location of main entrance gate and any other access gates as per project needs, Block wise FGL, Layout of main approach road to the plant, Internal and peripheral roads, Security



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Room/ cabin (s), all Buildings and Open installations with coordinates, Temporary Storage yard/ facility to be used by the contractor during construction, Proposed Array layout, Lightening arrester, UG/Over ground water Tank(s), Storm water drains, Corridor for buried cables etc.

- 9.3 The cable corridor shall be laid through clear gap between arrays and shall not be laid below modules for easy maintenance.
- 9.4 All the facilities and buildings shall be presented with suitable Legend.
- 9.5 The drawing shall be in suitable scale to have proper representation of the information.
- 9.6 The Plant & SPV module layout drawing shall be submitted by the contractor for review/ approval by the Engineer.

10 Design Loads

- 10.1 Unless otherwise specified elsewhere, Dead load, Live load, Wind load and Seismic load for buildings and structures shall be considered as per provisions of relevant BIS standards.
- 10.2 The following minimum imposed load as indicated for some of the important areas shall, however be considered for the design. If actual expected load is more than the specified minimum load, then actual load is to be considered.

S. No.	Area	Imposed (Live) Load
1	Roof	1.50 kN/ Sqm
2	Building floors (GF) & Grade Slab	10.00 kN/ Sqm
3	RCC Floors (General)	5.00 kN/ Sqm
4	Outdoor platforms, Stairs, Landing and Balconies, Walkway, Chequered plate & Grating (except cable trench cover)	5.00 kN/ Sqm
5	Road culverts & allied structures over drain & pipe crossings subjected to vehicular traffic	Design for Class – ‘AA’ loading (Wheeled & Tracked both) and check for Class – ‘A’ loading as per IRC Standard
6	Underground structures such as Sump, Pit, Trench, Drain, UG tank etc.	In addition to Earth pressure and Ground water table at FGL, a surcharge of 20kN /Sqm (10kN/Sqm for drains) shall also be considered. The structure shall be designed for following criteria – (a) Inside empty with outside fill+ surcharge



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		and water table at GL & (b) Inside water with no fill & water table outside
7	Pre-cast and chequered plate cover over cable trench	4.00 kN/ Sqm
8	Main access & Internal Roads	As per IRC SP 72 corresponding to vehicular traffic category T1 and critical in-field CBR

10.3 Primary Loads

- (i) Dead Load (DL)
- (ii) Live Load (LL)
- (iii) Wind Load (WL) – Both along $\pm X$ & $\pm Z$ horizontal direction
- (iv) Seismic Load (EL) – Both along $\pm X$ & $\pm Z$ horizontal direction

10.4 Basic wind speed (V_b) at project site shall be taken as per IS 875 (part-3) unless otherwise specified elsewhere.

10.5 To calculate the design wind speed (V_z), the factors k_1 (probability factor or risk coefficient), k_2 (terrain roughness and height factor) and k_3 (topography factor) shall be considered as per IS 875 (Part-3). However, minimum values for k_1 , k_2 and k_3 shall be 0.92, 1.05 and 1.0 respectively.

10.6 Topography factor ' k_3 ' shall be taken as 1.0 upto upwards slope of 3° . For topography with upward slope greater than 3° , the value of ' k_3 ' shall be calculated as per Annexure-C of IS 875 (Part-3).

10.7 The importance factor for cyclonic region, ' k_4 ' shall be taken as 1.15.

10.8 To calculate the design wind pressure ' p_d ', factors ' k_a ' (area averaging factor) and ' k_c ' (combination factor) shall be taken as 1.0. (The factor ' k_d ' shall be taken as 1.0 in case of plant site within 60km of sea coast).

10.9 The Seismic Load shall be considered corresponding to Earth quake zone at site (Seismic Zone – II) as per IS: 1893 (Part- 4) with Importance Factor 1.5. Ductile detailing as per IS 13920 shall be followed in concrete structures except in case of concrete support structure up to plinth level supporting open installations of inverter transformers and control panels at ICR/LCR, wherein the detailing shall conform to IS 456 and SP 34.

10.10 Notes for MMS Design

10.10.1 WL shall be considered as detailed below for estimation of WL under primary loads:

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- (i) WLx (downward), WLz (downward): Load due to positive pressure on design tilt angles of MMS members for wind acting in both ($\pm X$, $\pm Z$) directions.
- (ii) WLx (upward), WLz (upward): Load due to negative pressure on design tilt angles of MMS members for wind acting in both ($\pm X$, $\pm Z$) directions.
- (iii) WLx (member load), WLz (member load): Load due to wind action on side (exposed) face of respective MMS members (drag force) for wind acting in both ($\pm X$, $\pm Z$) directions.
 - $\pm WLx$ (member load, transverse to MMS table): Load due to wind action on column, front and back bracing, longitudinal bracing
 - $\pm WLz$ (member load, along length of MMS table): Load due to wind action on column, rafter front and back bracing, longitudinal bracing

10.10.2 For estimation of design wind loads on purlins (Table 8 of IS 875- Part 3), WL (downward) and WL (upward) on modules (laid in the profile of mono slope canopy) shall be applied such that the center of pressure should be at ($0.3 \times$ length of canopy) from windward end (for simplicity, the wind load distribution may be taken as triangular with max. value at windward end). Solidity ratio (ϕ) shall be taken as 0.0.

Note: Wind tunnel studies shall be specific to the site topography as well as array layout. The wind tunnel studies shall be conducted with appropriate scale model and boundary line tunnels and must be validated from an IIT.

10.10.3 In design of MMS (for height of structures less than 10 m from ground), 20% reduction in wind pressure as per Note under Cl. 6.3 of IS 875 – Part 3 is not permitted in case of purlins (members supporting modules), which shall be designed against action of WL corresponding to full wind pressure.

10.11 Design Load combinations

10.11.1 Appropriate Load factors in LSM design for concrete structures and appropriate Factor of safety in WSM design (ASD) for all steel structures including MMS shall be considered as per relevant BIS standard. No increase in permissible stress is permitted in design of MMS.

10.11.2 Following load combinations shall be considered in design:

- For MMS Design:
 - (i) DL+LL
 - (ii) DL+LL + WLx (upward) \pm WLx (member load)
 - (iii) DL+LL + WLx (downward) \pm WLx (member load)



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- (iv) $DL+LL + WLz$ (upward) $\pm WLz$ (member load)
- (v) $DL+LL + WLz$ (downward) $\pm WLz$ (member load)
- (vi) $DL+LL \pm ELx$
- (vii) $DL+LL \pm ELz$
- For RCC and Steel structures except MMS:
 - (i) $DL+LL$
 - (ii) $DL \pm WLx$
 - (iii) $DL \pm WLz$
 - (iv) $DL+LL \pm WLx$
 - (v) $DL+LL \pm WLz$
 - (vi) $DL+LL \pm ELx$
 - (vii) $DL+LL \pm ELz$

10.11.3 All buildings, structures and foundations shall be designed to withstand loads corresponding to worst design load combination.

11 Foundations (General)

- 11.1 Contractor shall design all foundations for buildings, equipment, HT line Towers, Switch yard structures, Transformer, MMS & other structures as per relevant BIS standards and recommendations of Geotechnical investigation report.
- 11.2 No foundation for MMS, buildings, switchyard equipment and structures, sub-stations, HT line towers, transformers, etc. shall rest on filled-up ground. However, minor structures like cable trench, cable rack, pipe pedestal, etc. may rest on filled-up soil with max. safe bearing capacity for design considerations not more than 3 T/Sqm.
- 11.3 Min. depth of foundation for all buildings and plinth for open installations shall be 1.5 m below NGL. For all other structures, min. depth of foundation shall be 1.0 m unless specified otherwise.
- 11.4 All foundations of a building shall be founded at same RL (Reduced level) with respect to foundation depth below lowest NGL (Natural ground level) in the building area. The Levels shall be obtained with reference to the already established TBM using digital survey instrument such as Total Station/ Auto Level.
- 11.5 All design & drawings shall be submitted to the Engineer for approval before execution.

12 MMS Foundation

- 12.1 MMS structure shall be supported on pre-cast RCC sleepers to be designed to withstand the loads coming from MMS and effectively transfer them to the ground.



Basic design philosophy of sleeper design shall be to counter the resultant uplift by its self-weight plus weight of superstructure while ensuring soil pressure at foundation level within safe bearing capacity under critical design load combination(s) ensuring required factor of safety. It is envisaged to have the founding level (top of mud mat) of the sleeper at 250mm below EGL. The sleeper shall be supported on PCC (1:3:6) mud mat of 100mm thickness. The grade of pre-cast RCC sleeper shall be min. M35.

12.2 The reinforcement shall be treated with anti-corrosion coating as per paint manufacturer's recommendations or shall be factory treated for anti-corrosion provisions.

12.3 The sleepers shall be shop manufactured with proper casting and curing facilities and shall conform to approved design and shall be transported to the site for installation.

13 Module Mounting Structure (MMS)

13.1 Module Mounting Structure (MMS) shall comprise of rafter members directly fixed over the pre-cast sleeper. The rafters shall support the purlin members, to which the modules shall be firmly secured either with clamps or appropriate number of bolts as per OEM specifications.

13.2 The module mounting structure design shall generally follow the existing land profile. The top of the table shall be in one plane.

13.3 In MMS analysis the column support shall be assumed at EGL/NGL.

13.4 In case of topographical variations more than 3°, the contractor shall carry out detailed study of its effect on array layout, shadow analysis and structural stability of MMS.

13.5 The structure shall be designed to allow easy replacement of any module and shall be in line with site requirements.

13.6 The MMS stub/ column, rafter, purlin, ties and bracing members shall conform to following Indian standards.

- IS: 2062 – Hot rolled Medium and High tensile structural steel
- IS: 811 – Cold formed light gauge structural steel sections
- IS: 1161 – Steel tubes for structural purposes
- IS: 4923 – Hollow steel sections for structural use
- Minimum grade of steel for sections conforming to IS: 811 & IS: 4923 shall be E350 conforming to IS: 2062 and Y_{st} 310 conforming to IS: 1608 respectively.

13.7 The contractor can also propose new light gauge structural steel other than specified in IS: 811 or structural aluminum sections subject to approval of the Engineer. In this



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case the contractor shall submit his proposal stating the technical advantages of the proposed sections for Engineer's review along with supporting literature and sample design calculations conforming to present specifications at the time of bidding.

- 13.8 Aluminum-Zinc Alloy metallic coated steel strip or sheet of grade YS350 and minimum coating class AZ200 conforming to IS 15961: 2012 may also be used for fabrication of purlin sections. In such a case, all the sections of the base metal exposed after cutting of members and punching of holes shall be provided with sprayed aluminium and zinc coating conforming to IS 5905.
- 13.9 If aluminum is used as the material for MMS, it shall employ anodized extruded aluminum sections of class designation 64430 and 65032 conforming to IS: 733 with minimum thickness of 4mm. The structural design shall conform to IS: 8147. No member shall be of length more than 4m.
- 13.10 If structural steel is used as the material for MMS, the minimum thickness excluding anti corrosive treatment (BMT) of various elements of MMS structure shall be as following:
- Stub/ column – 3.15mm,
 - Rafter – 2.5mm &
 - Purlin – Minimum thickness of the purlin section excluding anti corrosive treatment (BMT) shall be 1.5 mm. Aluminum-zinc alloy metallic coated steel strip or sheet of grade YS350 and min. coating class AZ150 conforming to IS-15961:2012 may also be used for fabrication of purlin sections. In such a case, all the sections of the base metal exposed after cutting of members and punching of holes shall be provided with sprayed aluminum and zinc coating conforming to IS-5905.
 - Other members – 2.0 mm
- 13.11 The primary loads and load combinations for design of MMS structure shall be as specified under Clause No. 10 (Design Loads). The design shall be done by Working stress method and no increase in allowable stress shall be permitted.
- 13.12 The maximum permissible deflection/ side sway limits for various elements of MMS under serviceability conditions shall be as following:
- Lateral deflection/ side sway for Column – Span/ 240
 - Vertical deflection for Rafter and Purlin – Span/ 180
 - Lateral deflection for Purlin – Span/240

13.13 In case of natural frequency in first mode less than 5 Hz, the design of the MMS



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structure shall also be checked against dynamic effects of wind as per provisions of IS – 875 (Part-3) using gust factor method.

13.14 The purlins shall be provided with min. following tie/sag rods or angles or channels:

- 1 no., in the middle of each span and shall connect all the purlin members
- 1 no., diagonal, at each corner in end spans

13.15 Lateral restraint to compression flange if any due to PV panels is not permitted in purlin design.

13.16 The vertical diagonal bracing shall be provided in end spans and every alternate span of each unit (table) of MMS.

13.17 MMS shall support SPV modules at a given orientation & tilt and shall absorb and transfer the mechanical loads to the ground through foundation system.

13.18 Welding of structure at site shall not be allowed and only bolted connections shall be used.

13.19 The structure steel used in MMS shall be hot dip galvanized with minimum GSM 610 kg/ sqm and/or minimum coating thickness of 80 microns for protection against corrosion. Galvanization shall conform to IS-2629, 4759 & 4736 as applicable.

13.20 It is to be ensured that before application of this coating, the steel surface shall be thoroughly cleaned of any paint, grease, rust, scale, acid or alkali or any foreign material likely to interfere with the coating process.

13.21 The bidder shall ensure that inner side is also provided with galvanization coating.

13.22 The galvanization shall be done after fabrication of members and cutting of holes to ensure galvanization of all cut/ exposed edges.

13.23 In case the proposed section is made up of Aluminum, anodized coating shall be Gr. AC25 and shall conform to IS: 1868.

13.24 The array structure shall be so designed that it will occupy minimum space without sacrificing the output from SPV panels at the same time.

13.25 Two numbers of anti-theft fasteners of stainless steel on two diagonally opposite corners for each module shall be provided. All fasteners and washers (2 round + 1 spring) both for MMS connections and fixing of PV Module shall be adequately protected from atmosphere and weather prevailing in the area.

13.26 All fasteners for fixing the module over MMS shall be of SS 316 with property class A2-80 conforming to relevant ISO standard and must sustain the adverse climatic conditions to ensure the life of the structure for 25 years. The rafter member shall be fixed to pre-cast concrete sleeper with SS chemical anchors of reputed make and type



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- with required strength as per design. If aluminum is used as the structural material for MMS, UV resistant PVC washer shall also be provided beneath the SS washer to break the contact between SS and aluminum surface to control the corrosion at joint location.
- 13.27 Min. diameter of bolt for MMS connections shall be 10mm (12 mm in case of single bolt connection for seasonal tilt) except at column-rafter connection, where it shall not be less than 12mm (not less than 16mm in case of single bolt connection for seasonal tilt). In case of fixed tilt, min. two number of bolts shall be provided at each joint.
- 13.28 Modules shall be clamped or bolted with the structure properly. The material of clamps shall be Al / SS having weather resistant properties. Clamp/bolt shall have EPDM rubber washer and shall be designed in such a way so as not to cast any shadow on the active part of a module.
- 13.29 The MMS foundation shall be designed as per Cl. No. 12.
- 13.30 VOID
- 13.31 VOID
- 13.32 The array structure shall be grounded properly using maintenance free earthing kit.
- 13.33 The bidder/manufacture shall specify installation details of the PV modules and the support structures with appropriate diagram and drawings.
- 13.34 The Bidder should design the structure height considering highest flood level at the site and the finished grade level. The minimum clearance between the lower edge of the module and the finished grade shall be the higher of (i) Highest flood level + 100mm and (ii) 500 mm, as applicable
- 13.35 The length of one unit (Table) of MMS shall generally not be more than 20m.
- 13.36 The length of any cold formed section (CFS) shall not be more than 5.5 m.
- 13.37 The purlin splice shall be near the zone of contra-flexure, i.e., within a distance of 0.15L to 0.25L from the support, where L is the respective span within which splicing is located.
- 13.38 The purlin splice shall comprise of flange and web splice plates and splice design shall conform to Annexure-F of BIS:800. For simplicity in fabrication, the splice member may be of CFS channel section without lips (CU).
- 13.39 For same member type, same section shall be used.
- 13.40 When any sag or tie member to the purlin (rod, angle or channel) is provided, it shall not be considered in modelling the structure for analysis except its effect as lateral support to the purlin members in strength design.
- 13.41 The contractor shall submit the detailed design calculations and drawings for MMS



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structure, bill of materials and their specifications/ standards to the Employer for approval before start of fabrication work as per the engineering work program (L2 schedule) as finalized during kick-off meeting.

14 Concrete Works

- 14.1 Construction of all RCC works shall be done with approved design mix and the materials used viz. Cement, coarse & fine aggregate, Reinforcement steel etc. shall conform to relevant BIS standards.
- 14.2 The minimum grade of concrete for all RCC works shall be M30 unless specified otherwise.
- 14.3 Unless otherwise specified elsewhere, PCC shall be of min. grade M10 (nominal mix 1:3:6) except for mud mat, back filling of ground pockets or leveling course which shall be of grade M7.5 (nominal mix 1:4:8).
- 14.4 Considering high chloride and sulfate content in ground water, Ordinary Portland Cement – 43 grade with C_3A content < 5% conforming to IS: 8112 or Portland slag cement with slag > 50% conforming to IS: 455 shall be used.
- 14.5 Reinforcement steel shall be of high strength TMT bars of grade Fe500 D conforming to IS: 1786.
- 14.6 All reinforcement shall be applied with corrosion resistant paint as per manufacturer's catalogue. The proposed treatment shall be subject to the approval of the owner/SECI. Contractor may also use readily available reinforcement steel, corrosion resistant (CRS) grade, or with factory applied corrosion resistant paint subject to the approval of the owner.
- 14.7 Unless specified otherwise for grouting works anti shrink ready mix grout of approved make or cement mortar (CM) grout with non-shrink compound shall be used. The grout shall be high strength grout having min. characteristic strength of 35 N/mm^2 at 28 days.

15 Miscellaneous Steel Works

- 15.1 Unless otherwise specified elsewhere, all structural steel work shall be designed as per provisions of IS: 800 with working stress method of design (WSD).
- 15.2 Structural steel hot rolled sections, flats and plates shall conform IS: 2062, structural Pipes shall be medium (M)/ high (H) grade conforming to IS: 1161, chequered plate shall conform to IS: 3502 and Hollow steel sections for structural purposes shall conform to IS: 4923.
- 15.3 Corrosion protection treatment for all equipment enclosures and structural members



including cladding sheets of MCR building shall be provided as per IS 800 considering environmental classification as “polluted coastal (as polluted inland plus high airborne salt levels), very severe or extreme” and for the design life of 25 years.

16 Buildings and Plinth for Open Installations

16.1 General Requirement

- 16.1.1 Plant buildings and plinth for open installations are required to be constructed for housing the electrical equipment/ panel and Control room cum office cum store (Main Control Room Building - MCR) for operation and maintenance of Photovoltaic Solar Power Plant. Security room at main gate shall also be provided to secure the plant from any theft/ burglary/unauthorized entry.
- 16.1.2 Inverter, Switchgear panel, Metering panel and associated equipment shall be installed on plinth as open installations. The plinth supporting the ICR/LCR equipment shall have RCC framed structure with foundations, columns and beams built up to the plinth level (FFL). Plinth filling shall be provided as per the specifications for the same stipulated by the Clause No. 21 in Section VII-B of the tender document. Flooring shall be provided using 40 mm thick Cement concrete (IPS) flooring (1:2:4), aggregate size 10 mm down, conforming to IS 2571 with 2mm thick Heavy duty epoxy coating (Industrial grade) of approved make on top as per manufacturer specifications. There shall be suitable provision for easy passage of O&M personnel, cable trench, operating area, etc. as required. Weather canopy shall be provided for all open installations. Canopy columns shall be supported on pedestals at plinth level.
- 16.1.3 Unless otherwise specified elsewhere, all buildings and plinth for open installations except Security room/ cabin shall have RCC framed structure. MCR shall be a pre-engineered building (PEB), placed on plinth having RCC framed structure with foundations, columns and beams built up to the plinth level (FFL). Plinth filling shall be provided as per the specifications for the same provided in the Clause No. 21 in the Technical Specifications. The plinth for open installations and equipment area shall be designed with OEM requirements to ensure all satisfactory operations. The security room shall be of prefabricated structure.
- 16.1.4 The minimum plinth height (FFL) for all buildings and open installations shall be 1000 mm above FGL.
- 16.1.5 All buildings shall have provision of adequate windows for natural light & ventilation, fire safety provisions and shall be designed as per provisions of National building code (NBC).



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16.1.6 The contractor shall submit the proposed equipment layout drawings to the Engineer for approval before development of Architectural drawings. The building layout, exterior elevations shall be aesthetically designed following good architectural practices to get a pleasant look. Roof slab shall have projection of 450mm beyond external walls. For weather protection all doors and windows shall be provided with 450mm wide chajja. However, chajja for rolling shutter shall be 750mm wide.

16.2 Functional requirements

16.2.1 MCR Building

For operation & maintenance of SPV Plant, unless otherwise specified elsewhere, Control room cum office area of MCR building shall provide following facilities.

- Air-conditioned area (with provision of split A/C unit of adequate capacity) for SCADA room (approx. carpet area 12m²), Conference room (approx. carpet area 15 m²) & Supervisor cabin and office area (approx. carpet area 20 m²)
- Store cum record room required to accommodate spares (minimum carpet area 15 m²)
- Battery room as per requirement
- Toilet block with separate gents and ladies wash room facilities (approx. total carpet area 12 m²)
- Pantry with service platform and utensil washing facilities (approx. carpet area 5 m²)
- Suitable provision for passage (for smooth movement of O & M personnel), cable trenches, operating area etc. (min. clear width 1500mm)

16.2.2 Pre-Engineered Building (PEB)



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16.2.2.1 General: PEB shall be made of structural steel construction with double skinned metal roofing and wall cladding of appropriate profile. PEB shall be complete with painting, metal fascia, 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. Foundation bolts for the PEB shall be heavy duty and provided with suitable corrosion protection treatment. Minimum diameter for the foundation bolts shall be 20 mm. The construction methodology for PEB shall also be submitted to the Employer/Owner for approval before start of works.

16.2.2.2 Structural and Material Specifications:

Component	Description	Reference Standard
Primary Structural Members: including the transverse rigid frames, columns, corner columns, end wall wind columns, beams, truss member, base plate.	Steel frame members with minimum thickness 4 mm with minimum yield strength of 345 MPa	IS2062 min Grade E250 Quality BR/ ASTM A572-12 Grade 50
Secondary Members: including 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.	Minimum thickness 3.15 mm. Secondary members for purlins and Girts shall have minimum yield strength of 345 MPa. Miscellaneous secondary members shall have minimum yield strength of 250 MPa.	IS 811 or ASTM A1003-12 steel sheets conforming to ASTM A1011-12b Grade 50
Wall Cladding	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/m ³ and thermal conductivity 0.019-2.2 W/(m.K) at 10°C. The PUF	



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Component	Description	Reference Standard
	panels shall be a factory made item ready for installation at site.	
Design Parameters and Design Loads		
Dead Load	Self-Weight of Structure including Purlins, Sheeting, Girts, Bracings, weight of turbo ventilators to be added as Dead load etc. Imposed Load (Live Loads) Live loads shall be as per IS – 875. For sloped roofs up to 10 deg. it shall be 0.75 KN/M ² .	
Wind Load	Design wind speed factors shall be as per IS: 875-III, however the minimum value of these factors shall be considered as K1 = 1.0, K2 = 1.0 & K3 = 1.0 for the design of PEB.	
Earthquake Load	All PEB structures shall be designed for Seismic forces. Vertical Deflection and Horizontal Sway Limits: a) Limiting Deflection: The limiting permissible vertical deflection for structural steel members shall be as per IS 800 2007. b) The limiting permissible horizontal deflection for as per IS 800 2007 code where 'h' is height of building at eaves.	
Paint and Coating	Steel 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	



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Component	Description	Reference Standard
	(nominal) primer coat on other side. SMP and polyester paints system shall conform to Product type 4 as per AS/ANZ 2728.	
Plinth Protection	750mm wide plinth protection minimum 75 mm thick of cement concrete 1:3:6 (1 cement : 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.	
Rolling shutter	Rolling shutter (mechanically 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 to IS:2108 and shall be designed to withstand a wind load without excessive deflection. Metal rolling shutters and rolling grills as IS: 6248.	
Doors and Windows	Door, window and ventilator frames shall be made of Aluminum sections (min. average thickness 2.0 mm), industrial grade, anodized (grade AC25, min. thickness 25 microns conforming to IS: 1868) or with polyester power coating (total DFT 50 microns conforming to IS: 13781). The door and window shutters shall be made of clear float/wired glass (min. thickness 6 mm) as per functional requirements. However, doors in toilet shall be made of steel frame with solid core (MDF) flush shutter, 35 mm thick, with laminated finish conforming to IS: 2202. All windows shall be provided with suitable Al grill of anodized section with adequate thickness. All doors, windows and ventilators to be provided with all necessary fittings and fixtures like handles, tower bolts, wind stays, hinges, etc. of heavy duty anodized Al (min. thickness of coating 20 micron). All doors shall be provided with hydraulic door closures of adequate capacity. Entrance door and doors in passage shall be min. 1.5 m wide (double leaf) x 2.1 m height, while door in Conference Room and Store Room shall be min. 1.2 m wide x 2.1 m height. All other doors shall be min. 1.0 m wide x 2.2 m height except for WC, which may be of 0.8 m width.	



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Component	Description	Reference Standard
Roof Insulation and type	Both metal sheets shall have an under insulation of minimum 70 mm thick PUF with density 40 +/- kg/m ³ 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. 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 anticapillary flute in side lap shall be provided. 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. Contractor may also alternatively make the PEB roofing with composite slab (RCC slab with permanent formwork). The composite slab scheme, design and drawings shall be subject to approval from Employer/Owner before start of work.	
Wall Insulation	All voids of external and internal metal walls shall have an under insulation of minimum 60 mm thick PUF with density 40 +/- kg/m ³ 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. Masonry partition walls shall be provided for Kitchen, Pantry, Battery room and Toilet units.	

16.2.3 Security Room

16.2.3.1 The Contractor shall provide one security room at Main entry gate.

16.2.3.2 The security room shall be of min. size 3m x 3m x 2.75m height.

16.2.3.3 Security room shall be a pre-engineered & pre-fabricated structure. The walls and roof of the building shall be fabricated with double skin insulated sandwiched Al-Zn alloy coated high tensile steel metal panels (BMT- 0.5mm, Al-Zn alloy coating -150 GSM total on both sides). The insulation shall be of PUF with min. density 40 kg/



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- cum and adequate thickness. Roof shall be provided with suitable slope, not less than 10° to the horizontal (approx. 1V:6H) for proper drainage of rain water and shall project 300mm beyond the walls. The make and (color) shade of pre-coated metal panels shall be subject to approval by the Engineer. Min. thickness of color coating shall be 20 micron (DFT) excluding prime coat 5 micron (DFT). The coating system shall confirm to IS: 15965.
- 16.2.3.4 The security room shall be provided with one Aluminum (AL) glazed door (0.75m wide x 2.1m height) on one face and AL glazed sliding windows (1.2m width x 1.0 m height) with AL grill on remaining three sides. All glazing shall be of clear float glass with thickness of 4mm for window and 6 mm for door panel.
- 16.2.3.5 The door and windows shall be provided with all necessary fitting and fixtures like handles, tower bolts, mortise lock for door, stays, door stopper etc. All AL sections for doors and windows shall be anodized (min. average thickness 25 microns) or polyester powder coated (min. DFT 50 microns) with approved color shade for protection against weather.
- 16.2.3.6 Specially coated/ SS self-drilling screws/ fasteners conforming to class 3 as per ASTM: 3566.1 and 3566.2 shall only be used for all connections.
- 16.2.3.7 Anchor/ foundation bolts shall conform to IS: 5624 and IS 800.
- 16.2.3.8 The Security Room shall be supported on RCC framed structure with columns supported on foundations.
- 16.3 The Design and drawings shall be submitted for approval prior to fabrication and installation.
- 17 Flooring, Skirting and Dado**
- 17.1 Store area, Equipment Area
40 mm thick Cement concrete (IPS) flooring (1:2:4), aggregate size 10 mm down, conforming to IS 2571 with 2mm thick Heavy-duty epoxy coating (Industrial grade) of approved make on top as per manufacturer specifications and 10mm thick matching skirting of 100mm height.
- 17.2 SCADA Room, Control cum Office Room, Supervisor Room and Lobby
1200 mm X 1200 mm thick Heavy duty vitrified tile (8mm thick or more) flooring with matching skirting of 100mm height.
- 17.3 Battery Area/Room



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Acid/ Alkali resistant tile flooring and 2100 height dado, Floor and dado tiles - 20mm and 12 mm thick respectively. However, in case of maintenance free batteries, vitrified tile (8mm thick) flooring and dado shall be provided.

17.4 Toilet

- 40 mm thick Ceramic tile (8mm thick) flooring and glazed tile (6mm thick) 2100 height dado.
- 20mm thick Granite stone finish over platform for wash basin.

17.5 Pantry

40 mm thick heavy duty vitrified tile (8 mm thick) flooring and glazed tile (6mm thick) 2100 mm height dado, 20mm thick Granite stone finish over service platform.

17.6 Passage/ Corridor

40 mm thick Heavy duty vitrified tile (8mm thick) flooring with matching skirting of 100mm height.

17.7 Steps

Kota stone (20 thick) or 50 thick cement concrete (IPS) flooring conforming to IS 2571.

17.8 All items shall be of reputed make. Only Items with approved samples by the Engineer shall be used.

18 **VOID**

19 **Roofing**

19.1 The roof of all buildings shall be provided with min. slope of 1:100 for effective drainage of rain water.

19.2 Required no. of rain water down take pipes min. 100mm dia. PVC pipes (UV resistant) shall be provided for rain water disposal.

20 **Plinth protection and drain**

20.1 750mm wide plinth protection with min. 75mm thickness of PCC (1:3:6) over 75 mm thick bed of dry brick ballast, 40mm nominal size well rammed and consolidated and grouted with fine sand, shall be provided around all the buildings.

20.2 A peripheral drain (except for Security room/ cabin) of min. internal size 250mm x 250mm with brick walls in CM 1:6 over 75mm thick PCC (1:3:6) bedding with 12mm thick plaster in CM 1:5 and 25thk PCC (1:3:6) coping at top shall be provided along the periphery of the plinth protection for collection and disposal of rain water from building



roof.

21 Plinth filling for buildings

Plinth beam, when provided, shall be taken minimum 200mm below FGL. The plinth filling below Ground floor (GF) for all buildings shall be provided with following specifications.

- (i) Well compacted sub-grade
- (ii) Well compacted boulder soling with interstices filled with sand over compacted sub-grade.
- (iii) 75mm thick PCC 1:3:6 over (ii)
- (iv) 100mm thick PCC 1:2:4 over (iii)
- (v) 40mm thick floor finish over (iv)

22 Anti- termite Treatment

In case of presence of termites at the project site, an anti-termite treatment shall be provided for all foundation pits and building plinth in MCR building conforming to IS: 6313 to control entry of termites

23 Plumbing & Sanitary Works

23.1 Toilet block shall have following min. fittings:

- Wall mounted WC (Western type) 390 mm high with toilet paper roll holder, low height flushing tank and all fittings
- A set of 2 wall mounted Urinals (430 x 260 x 350 mm size) with flushing tank and all fittings (Gent's wash room only)
- Wash basin (550 x 400 mm) over concrete platform with all fittings including 2-pillar cocks
- Wall mirror (600 x 450 x 6 mm thick clear float glass) with hard board backing
- CP brass towel rail (600 x 20 mm) with C.P. brass brackets – one each in common area and bathroom (bathroom if applicable)
- Soap holder and liquid soap dispenser one each in common area and bathroom (bathroom if applicable)
- Shower and mixer for hot and cold water in bathroom (if applicable)
- Ventilators – Mechanical exhaust facility of adequate capacity
- Overhead PVC water storage tank – Capacity 1000 litres (common for both wash rooms) (2000 litres in case bathroom is to be provided)



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- 23.2 Pantry room shall be provided with kitchen sink cum drain board and provision for installation of Water Cooler.
- 23.3 One toilet room with provision of WC and Wash basin shall be provided at Security Room near main gate.
- 23.4 Necessary plumbing lines for MCR building and Security Room near main gate.
- 23.5 All sanitary ware, fittings and fixtures shall be of reputed Make and Type and approved by the Engineer. All fittings, fastener, grating shall be of CP brass conforming to relevant BIS standards.

24 Painting & Other Finishes

Painting and white wash/ colour wash for the buildings shall conform to relevant BIS standards. The make and colour shade of the finish shall be as advised and approved by the Engineer.

Internal masonry walls except toilets & battery room	Acrylic emulsion (for MCR) & Oil bound distemper (for LCR/ Security Room)
Battery room	Acid/ Alkali resistant tiled dado of 2100 mm height & Acid resistant resin-based epoxy paint above dado (Vitrified tile flooring and dado with oil bound distemper in case of maintenance free batteries)
Toilet	Oil bound distemper
MMS foundations/ Earth pit Enclosure	Cement paint
Air-conditioned areas	Underside of roof slab- Under deck insulation with 50mm thick mineral wool, min. density 45 kg/ m ³ and Gypsum board false ceiling with GI grid/ Gypsum tile (600x600 mm x 12 thick) false ceiling with AL grid as per manufacturer details

25 Air conditioning & Ventilation for MCR and Other Buildings

- 25.1 All buildings shall be equipped with appropriate numbers of fans for effective heat dissipation.
- 25.2 In MCR building, the supervisor room, Conference room and SCADA room shall have split type air conditioning units.

26 Fire Extinguishers

- 26.1 All buildings shall be installed with required no. of fire extinguishers as per relevant BIS



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standard and NBC. LiquefiedCO₂/ foam/ ABC type fire extinguisher shall be upright type of capacity 10kg conforming to IS: 2171, IS: 10658.

26.2 The fire extinguisher shall be suitable for fighting fire of Oils, Solvents, Gases, Paints, Varnishes, Electrical Wiring, Live Machinery Fires, and all Flammable Liquid & Gas.

27 Sand buckets

27.1 Sand buckets shall be wall mounted made from at least 24SWG sheet with bracket fixing on wall conforming to IS: 2546.

27.2 All buildings shall be provided with required no. of sand buckets as per relevant BIS standard and NBC. 4 No. of Bucket stands with four buckets on each stand shall be provided in the Transformer Yard.

28 Sign Boards and Danger Boards

28.1 The sign board containing brief description of major components of the power plant as well as the complete power plant in general shall be installed at appropriate locations of the power plant as approved by Engineer

28.2 The Signboard shall be made of steel plate of not less than 3 mm. Letters on the board shall be with appropriate illumination arrangements.

28.3 Safety signs, building evacuation plan and direction signs, assembly points shall also be placed at strategic locations.

28.4 The Contractor shall provide to the Engineer, detailed specifications of the sign boards.

29 Masonry Work

29.1 The masonry work shall be of bricks, laterite blocks (as per site conditions) or concrete blocks.

29.2 All external walls of buildings shall be 230mm and internal walls shall be 230mm or 115mm as per requirements.

29.3 All concrete block masonry walls shall be min. 200mm thick.

29.4 Brick work shall be in cement mortar (CM) 1:6 & 1:4 for 230 mm and 115 mm thick brick wall respectively unless specified.

29.5 Unless otherwise specified elsewhere, Bricks shall be of class designation 7.5 conforming to IS: 1077, IS: 2212 & IS: 3495.

29.6 All concrete blocks shall be of min. compressive strength of 7.5 N/mm² and shall be of Grade-A conforming to IS: 2185.

29.7 The laterite blocks shall conform to IS: 3620.

29.8 All buildings shall be provided with suitable damp-proof course (DPC). The DPC shall



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be with PCC (1:2:4) using 6 down coarse aggregate and water proofing admixture. The min. thickness of DPC shall be 40mm.

29.9 The construction of brick masonry shall conform to IS: 2212. Construction of Concrete block masonry shall conform to IS: 2572.

30 Plastering, Pointing & Coping Works

30.1 All brick masonry work shall be provided with plaster.

30.2 Wall and ceiling plaster shall be in cement mortar (CM) 1:6 and 1:3 respectively.

30.3 Thickness of plaster shall be 18mm and 12mm respectively for rough and smooth surface of the masonry wall. The ceiling plaster shall be 6mm thick.

30.4 All joints in stone masonry shall be raked and pointed in cement mortar (CM) 1:3 except specified otherwise.

30.5 Exposed top surface of brick or stone masonry shall be provided with 25 mm thick plain cement concrete (PCC) coping (1:2:4) with trawl finish. All exposed coping shall be provided with suitable slope and projection for easy drainage of water.

30.6 All door and window chajja shall be provided with 10mm wide drip course.

31 Building Water Supply & Plumbing Works

31.1 C-PVC pipes shall be used for all internal building water supply works while all external water supply pipes shall be uPVC conforming to relevant BIS standard.

31.2 Rain water pipe shall be of PVC conforming to relevant BIS standard.

31.3 All sewerage, waste water and ventilation pipes shall be of HDPE conforming to relevant BIS standard.

31.4 MCR building and Security room shall be connected to Sewage treatment facility including all associated works like Manholes etc.

32 Sewage Treatment facility

32.1 The Contractor shall design & provide soak pit and septic tank for treatment of sewage and waste water from MCR building and Security Room. The design of the septic tank shall conform to IS 2470 (Part 1). However, in case of ground water within 1.5m of finished grade level or the soil strata being of low permeability (permeability $\leq 10^{-6}$ m/s) where septic tank and soak pit arrangement is not effective, suitable packaged sewage treatment plant of reputed make/manufacture shall be provided. The sewage treatment facility shall be of required capacity and of proven design suitable for total of 15 people.

33 Pipe & Cable Trenches



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- 33.1 All trenches inside the building and transformer area shall be of RCC. The min. wall and base slab thickness shall be 100mm for depth \leq 850mm and 150mm for depths $>$ 850mm.
- 33.2 The trench shall be designed for loads as specified under 'Design Loads'. External trenches shall be kept min. 100mm above FGL to avoid entry of rain water. In case of straight length of the trench being more than 40m, suitable expansion joints with PVC water stop shall be provided.
- 33.3 Internal trenches (inside buildings) shall be provided with chequered plate (min. 8mm thick with stiffening angle ISA 50x50x6 @ 750 mm c/c for trench width greater than 800 mm) covers while external trench shall have precast concrete covers.
- 33.4 Min. thickness of precast cover shall be 50mm. Both bearing edges of the cable trench and all edges of pre-cast concrete covers shall be provided with min. 50x50x6 mm edge protection angle with lugs.
- 33.5 The trench cover (chequered or pre – cast both) shall be provided with suitable lifting hooks.
- 33.6 As required suitable MS insert plates shall be provided on trench wall to support the cable rack/ pipe.
- 33.7 The trench bed shall have a slope of approx. 1(V):250(H) along and 1(V):50(H) across the length of the trench. The cable trench shall have a dewatering sump (s) of size 450x450x450 mm depth at suitable location to facilitate collection & pumping out of rain water from the trench.

34 Transformer Yard Civil Works

- 34.1 Transformer and equipment foundations shall be founded on isolated spread footings or block foundation depending on the final geotechnical investigation report and functional requirements.
- 34.2 In case of transformer oil tank capacity \geq 2000 litres, the transformer foundation shall have its own soak pit which would cover the area of the transformer and cooler banks, so as to collect any spillage of oil in case of emergency. The retention capacity of the soak pit shall be equal to volume of the transformer oil (excluding free space above gravel) and it shall be filled with granite stone gravel of size 40mm, uniformly graded, with 200 mm free space above gravel fill.
- 34.3 In case of transformer oil tank capacity more \geq 20000 litres, the soak pit shall be connected to a separate burnt oil pit through discharge pipe (300 mm dia) and shall be suitably sized to accommodate full oil volume (excluding free board above inlet pipe)



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of the transformer connected to it, without backflow. In this case the capacity of the soak pit may be reduced to min. $1/3^{\text{rd}}$ of the total transformer oil volume. The burnt oil pit shall be further connected to oily water drainage system. The water shall be discharged into the nearest drain by gravity flow or pumping after suitable treatment as per statutory and code provisions.

- 34.4 Both, the transformer soak including side walls and the burnt oil pit shall be of RCC and shall be provided with sump (min. 500 mm x 500 mm x 400mm deep) and slope of 1:50 in concrete screed of 1:1.5:3 to the floor slab towards the sump pit. The oil collection pit shall be provided with 20mm dia. MS rung ladder with 2 coats of epoxy paint over 2 coats of primer, a manhole & removable RCC cover. The inside of oil collection pit shall be plastered with 6 mm thick CM 1:6 and painted with 2 coats of epoxy paint over 2 coats of primer.
- 34.5 The area around the transformer and equipment shall be covered with uniformly graded granite stone gravel of size 40mm.
- 34.6 The area shall be provided with galvanized chain link fence of height min 1.8m with 3.5m wide gate. The specifications for fencing shall be similar to those specified under Cl. No. 31.3 except fence post which shall be of MS angle (ISA 65x65x6) spaced at 2.5 m c/c.
- 34.7 The Gate of size 3.5m shall be of MS pipe (medium class conforming to IS: 1161) frame with hard drawn steel wire fabric mesh (50x50mmx3mm thick conforming to IS: 1566) including all accessories and fittings. MS angle posts shall conform to IS 2062.
- 34.8 In addition to main gate a wicket gate of MS pipe (medium class conforming to IS: 1161) frame with 1.0 m width with hard drawn steel wire fabric (50x50x3mm thick conforming to IS: 1566) shall be provided for man entry for maintenance purpose.
- 34.9 The transformer yard fencing work shall conform to CEIG requirements.
- 34.10 The requirement of fire barrier wall between transformers shall be as per Electricity Rules and IS: 1646 recommendations. Minimum wall thickness shall be 230mm for RCC wall and 300mm for masonry wall.

35 PV Module Cleaning System – Wet or Dry Type

Wet type Cleaning System

- 35.1 The contractor shall design and install the effective module cleaning system.
- 35.2 A regular supply of suitable quantity of water shall be ensured by the contractor to cater day-to-day requirement of drinking water and for cleaning of PV modules during entire O&M period.



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- 35.3 The Contractor shall estimate the water requirements for cleaning the photovoltaic modules at least once in two week or at closer frequency as per the soiling conditions prevailing at site, in order to operate the plant at its guaranteed plant performance. Also, the contractor is required to plan the water storage accordingly with provision of a tank of suitable capacity for this purpose. However, min. consumption of 2 Ltr / Sqm of surface area of SPV module shall be considered in estimation of required quantity of water storage.
- 35.4 As the ground water contains high concentration of chlorides, it is not suitable for construction and module cleaning purposes. Suitable water for construction and module cleaning purposes (during plant operation) including its storage shall be arranged by the Contractor.
- 35.5 Water used for drinking & PV module cleaning purpose shall generally be of potable quality and fit for cleaning the modules with TDS generally not more than 75 PPM. In case of higher salt contents, the water shall be thoroughly squeezed off to prevent salt deposition over module surface. However, water with TDS more than 200 PPM shall not be used directly for module cleaning without suitable treatment to control the TDS within acceptable limits. The water must be free from any grit and any physical contaminants that could damage the panel surface.
- 35.6 If required, for settlement of any grit/ unacceptable suspended particles in the water a settling tank shall be installed before the inlet of the storage tank. Suitable arrangement for discharge/ disposal of sediment/ slush shall be provided in silting chamber by gravity disposal in surface drain or with provision of sludge sump and pump of adequate capacity.
- 35.7 The module cleaning system shall include construction of RCC tank or supply and installation of Ground mounted PVC tank (s) of required storage capacity, pumps (including 1 No. standby pump), water supply mains and flexible hose pipes, taps, valves (NRV, Butterfly valve, Ball valve, Gate valve, PRV, scour valve etc.), Water hammer arrester(s), pressure gauge, flow meter etc. as per the planning & design.
- 35.8 In case of over ground water storage tank, the contractor shall check its effect on plant performance through shadow analysis. The PVC storage tank shall conform to IS: 12701. The valves shall conform to IS: 778. A suitable metal sheet canopy for protection from direct sunlight shall be provided over the tank area.
- 35.9 The water supply mains could be either of GI, uPVC or HDPE, however, the vertical pipe connecting supply main to the discharge point shall be of GI.



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- 35.10 Masonry chamber shall be provided for Main gate valve at pump end. Whereas, as per requirements, at other locations either a masonry or GI/ HDPE pipe chamber may be provided.
- 35.11 Module cleaning procedure and pressure requirement at discharge point shall be as per the recommendation of PV module manufacturer. However, discharge pressure at outlet shall not be less than 5 kgf/cm² (0.5 MPa).
- 35.12 All the pipes thus laid shall be buried in ground at least 150mm below FGL or laid above ground clamping on suitable concrete support blocks. In case of above ground piping only GI pipes shall be used.

Dry Cleaning System

- 35.13 Alternate to Wet type Module Cleaning System as stipulated in the above Clauses, the Contractor may propose Robotic type dry cleaning system with micro-fibre based brushes to avoid scratches on the PV Module. The Contractor shall also ensure following considerations during design:
- 35.13.1 The necessary design considerations for the mounting the robotic system shall be incorporated in the Module Mounting Structure design, foundation design as well as PV array layout, in addition to the specifications provided elsewhere in this Section.
- 35.13.2 The system shall be designed for operation under the climatic conditions at site.
- 35.13.3 The Robotic Cleaning system shall be self-powered, with battery backup (no external supply). The battery shall be compliant with IEC 62133: Secondary cells and batteries containing alkaline or other non-acid electrolytes - Safety requirements for portable sealed secondary cells, and for batteries made from them, for use in portable applications.
- 35.13.4 The Robotic Cleaning system shall be integrated with the Plant SCADA.

36 Overground Water Tank

- 36.1 Water Storage tank (wherever required) of required capacity shall be of overhead/overground type and made of RCC or PVC as per design requirements.
- 36.2 The tank shall have clear free board of 300mm above MWL.
- 36.3 For RCC water tank, the tank bottom shall have a slope of 1:100 towards drainage sump (500x500x500 mm deep). The slope shall be provided either in structural slab or in screed concrete (1:2:4) trawl finished. 1000x1000 mm size Manhole in roof slab and 20 mm MS rung ladder shall be provided for easy access to the storage tank and silting chamber for periodic cleaning. The manhole shall be covered with RCC precast cover. 50x50x6 mm MS angle with lugs shall be provided around precast cover and tank slab



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opening for edge protection. Rungs shall be painted with 2 coats of epoxy paint over 2 coats of primer.

- 36.4 The design of tank, when made of RCC, shall conform to IS: 3370 with maximum crack width of 0.1mm for wall, bottom slab and roof slab. Min. grade of concrete shall be M35 conforming to IS: 456. Suitable construction joints shall be provided as per provisions of IS: 3370 (Part 1). Water proofing admixture conforming to relevant BIS standard and of approved make shall be added to concrete as per manufacturer's recommendations.
- 36.5 The RCC water tank shall be tested for water tightness as per the provisions of IS 3370 (Part-4). In case any leakage is noticed the same shall be repaired by injection of cement grout installing suitable nozzles around affected areas. Outside face of water tank in contact with water and soil and underside of roof slab shall be painted with 2 coats of epoxy paint.
- 36.6 Water tank when made of PVC shall conform to IS: 12701.

37 Transmission Line Structures

- 37.1 Galvanized 220 kV and 132 kV Transmission Line towers, Tower extensions & accessories and 11 kV, 22kV, 22kV & 33 kV transmission poles, towers & accessories shall be designed following latest guidelines of respective SEB (State electricity board)/ STU (State transmission utility) and get approved from them before execution. In absence of SEB/ STU guidelines REC (Rural Electrification Corporation) standards may be followed. Support at corner with angle > 100 shall be provided with a 4-pole structure or a lattice tower structure. Use of PCC spun pole and RCC pole is not acceptable.
- 37.2 Approved copies of these designs & drawings shall be submitted to the employer for reference and record.

38 Miscellaneous structures

38.1 Support structure for weather monitoring device

- 38.1.1 Weather monitoring device shall be mounted on tubular steel pole of required height. The pole shall conform to IS: 2713.
- 38.1.2 The pole shall be secured to an independent RCC foundation structure through Base plate and Anchor bolt assembly.
- 38.1.3 200 long 20 dia. rods shall be welded to the pole at 300 mm C/c for access to the device for maintenance purpose.
- 38.1.4 The support structure shall be hot dip galvanized.



38.2 Support structures for SCB

38.3 When supported independently, the SCB shall be mounted on a structural steel supporting frame of galvanized ISMC 75.

38.3.1 Column post and bracings shall be supported with 300 mm (min.) diameter and 850 mm (min.) deep below GL piles in cement concrete (nominal mix 1:1:2). The column post and bracings shall be extended into the piles upto 800 mm with 50mm cover at the bottom.

38.3.2 The pile shall project 200 mm above GL.

38.3.3 The support structure shall hot-dip galvanized and of adequate height to ensure min. ground clearance of .8 m to SCB unit.

D Quality Assurance and Inspection of Civil Works

1 Introduction

1.1 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.

1.2 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.

1.3 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.

1.4 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.

1.5 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 from statutory authorities etc. if any and the same shall be got approved from the Engineer.

1.6 If required, work methodology may be revised/ reviewed at every stage of execution of work at site, to suit the site conditions, work progress commensurate with project



schedule by the contractor at no extra cost to the Engineer

2 QA and QC Manpower

- 2.1 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.
- 2.2 All correspondence related to Quality Assurance shall be addressed by the contractor's QA coordinator to the Engineer.
- 2.3 Employer/ Consultant 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 Engineer on the other hand.
- 2.4 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.
- 2.5 The contractor shall finalize and submit a deployment schedule of QA & QC personnel along with their details to Engineer for approval/ acceptance and further shall ensure their availability well before the start of the concern activity.

3 Laboratory and Field Testing

- 3.1 The contractor shall make necessary provisions to provide all facilities required for QA & QC activities by setting up a field laboratory for QA and QC activities in line with the indicative field QA & QC laboratory set-up.
- 3.2 The Laboratory building shall be constructed and installed with adequate facilities to meet the requirement of envisaged test setup. Temperature and humidity controls shall be available wherever necessary during testing of samples.
- 3.3 The quality plan shall identify the testing equipment/ instrument, which the contractor shall deploy and equip the field quality laboratory for meeting the field quality plan requirements.
- 3.4 The contractor shall furnish a comprehensive list of testing equipment/ instrument required to meet the planned/scheduled tests for the execution of works for Engineer's acceptance/ approval.
- 3.5 The contractor shall mobilize the requisite laboratory equipment and QA & QC manpower at least 15 days prior to the planned test activity as per the schedule of tests.
- 3.6 In case contractor desires to hire the services of any established laboratory nearby for



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any field tests then he shall ensure that the subject laboratory is well equipped with all requisite testing facilities and qualified QA & QC staff and this shall not affect in anyway the work progress.

- 3.7 All equipment and instruments in the laboratory/ field shall be calibrated before the commencement of tests and then at regular intervals, as per the manufacturer's recommendation and as directed by the Engineer. The calibration certificates shall specify the fitness of the equipment and instruments within the limit of tolerance for use. Contractor shall arrange for calibration of equipment and instruments by an NABL / NPL accredited agency and the calibration report shall be submitted to Engineer.
- 3.8 The tests which cannot be carried out in the field laboratory shall be done at a laboratory of repute. This includes selected 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 thereafter these shall be sent to the concerned laboratory through the covering letter signed by Engineer. Test report along with the recommendations shall be obtained from the laboratories without delay and submitted to Engineer.
- 3.9 Based on the schedule of work agreed with the Engineer and the approved FQP, the contractor shall prepare a schedule of tests and submit them to the Engineer and organize to carry out the tests as scheduled/agreed.

4 Sampling and Testing of Construction Materials

- 4.1 The method of sampling for testing of construction materials and work / job samples shall be as per the relevant BIS / standards / codes and in line with the requirements of the technical specifications / quality plans.
- 4.2 All samples shall be jointly drawn, signed and sealed wherever required, by the contractor and the engineer or his authorized representative.
- 4.3 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 of the Engineer.
- 4.4 All testing shall be done in the presence of Engineer or his authorized representative in a NABL accredited / Govt. Laboratory acceptable to Engineer.
- 4.5 The test samples shall be jointly selected and sealed and signed by the Site-in-charge and thereafter these shall be sent to the concerned laboratory.
- 4.6 The test report along with the recommendations shall be obtained from the laboratory



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without delay and submitted to Engineer.

5 Purchase and Service

- 5.1 All structural steel shall be procured only from main steel producers. 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 cleared by the Engineer for which details such as BIS approval, main steel producer's approval, past experience for production of sections of specified material, details of machines, plant, testing facilities etc.
- 5.2 Confirmation that the process control and manufacturing of steel sections by re-rollers shall be same as that of main steel producers, that billets for re-rolling will only be sourced from main steel producers shall be furnished with regard to re-roller.
- 5.3 For Module Mounting Structures (MMS), sources of steel other than those specified under this clause may also be used subject to the condition that they otherwise meet the requirements of the Technical Specifications / Bid documents. Even after clearance of re-rollers, induction of billets with identified and correlated Mill test certificates (MTC) in the process of re-rolling, sampling of steel, quality checks thereof and stamping of final product for further identification and correlation with MTC prior to dispatch shall be the responsibility of the contractor and these shall be performed in presence of the authorized representative of the main Contractor.
- 5.4 Reinforcement steel shall be procured only from main steel producers and Mill test certificates (MTC) shall be obtained and submitted to the Engineer for correlation.

6 Field Quality Plan

- 6.1 Well before the start of the work, the contractor shall prepare and submit the Field Quality Plans to Employer for approval, which shall detail out for all the works, equipment, services, quality practices and procedures etc. in line with the requirement of the technical specifications to be followed by the contractor at site.
- 6.2 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.
- 6.3 An Indicative Field & Manufacturing Quality Plan for civil, structural and MMS works is enclosed with this specification for reference as Annexure-B.

7 General QA Requirements

- 7.1 The contractor shall ensure that the works, BOIs and services under the scope of Contract, whether manufactured or performed within contractor's works or at his



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subcontractor's premises or at the project site or at any other place of work, are in accordance with Technical specification, applicable standards / codes, approved drawings / data sheets / quality plans and BOQ. All the works, BOIs and services shall be carried out as per the best prevalent engineering practices and to the directions of the Engineer.

Equipment	UOM	Approx. Qty.
Cube moulds for cement testing	nos.	4
Sieve shaker	nos.	1
Sieve for sand, coarse and fine aggregate	set	1
Sieve for coarse aggregate	set	1
Slump testing equipment	nos.	6
Oven	nos.	2
Physical balance	nos.	1
Thermometer	nos.	4
Burret	nos.	2
Measuring cylinder	nos.	9
Measuring flask	nos.	3
Compression testing machine	set	1
Cube mould for concrete	nos.	10
Mechanical weighing machine	nos.	1 (100kg capacity)
Drum type concrete mixer (for trial mixes)	nos.	1
Proctor testing equipment	set	1

7.2 Notes

- The equipment listed above is indicative and minimum required. Additional equipment, if any, required for successful completion of work shall be provided /arranged by the contractor.
- All test reports/ inspection reports shall be submitted in soft copy also and shall be available at site for easy access to the Engineer.
- Based on the schedule (L2/L3 Network), Quality control & Quality Assurance Work plan shall be finalized by the contractor and the same shall be submitted to Engineer for acceptance/approval.



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Annexure – A

**Pre-dispatch Inspection Protocol for Crystalline PV Modules by
Employer or Employer Deputed Agency**

**5 MW (AC) Grid Connected
Solar PV Plant at VOCPT,
Tuticorin**

**Tender No.
SECI/C&P/NIT/2021/VOCPT5**

**ANNEXURE-A
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**Signature of
Bidder**



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Pre-dispatch inspection procedure

1. Objective:

The objective of this document is to establish General inspection protocol with objectivity for verification of Quality Parameters of Solar Modules by the customer (or its authorised inspection agency) prior to dispatch. The decision rules and procedure specified herein seek to uphold quality standards based on industry best practices and technical specifications laid out in tender documents as well as to control risks associated with item procurement.

2. Standards and Codes (as applicable):

1. Sampling for determining Acceptance Quality Level (AQL) shall follow ISO 2859-1: 1999.
2. IEC TS 60904-1-2:2019 - Photovoltaic devices - Part 1-2: Measurement of current-voltage characteristics of bifacial photovoltaic (PV) devices

3. Definitions:

1. Lot: All products/items manufactured in one batch.
Notwithstanding the aforementioned definition, the customer or authorized inspection agency can lay down alternate/additional criteria for determining a lot.
2. Major Defect: A defect that reduces the usability or causes the product to fail to fulfil its nominal characteristic function.
3. Minor Defect: A defect that does not reduce the usability of the product, but does not meet the quality standard.

4. Inspection Schedule:

Customer representative shall propose the schedule for Pre-despatch Inspection of Finished Goods to the Customer well in advance, and in no case less than 3 working days prior to commencement of Inspection at a location within India and 7 days in case of a foreign country.

5. Scope of Inspection:

Supplier representative will accompany the Inspector while doing the inspection which shall typically consist of 2 steps for clearance of each Lot:

BOM verification: To be conducted prior to the commencement of production.



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The details of materials used will be verified from the ERP/Manufacturing data and corroborated with the Construction Data Form (CDF). This shall include verification of following:

Item	Method of Verification
Shelf life of the following BOM items: <ul style="list-style-type: none">EVAPV Module Back sheetSealant and potting material (Silicone)	Verify the expiry date/shelf life and storage conditions <i>The PV Module manufacturer shall submit all required information to prove that materials being used are within their shelf life.</i>

Note: Supplier shall provide the necessary documents for approval of BOM as per IEC standards and tender Technical Specifications.

Witness Tests:

Manufacturer shall assist the Inspecting agency to witness following checks, the details of which are provided elsewhere in this document:

- I. Flash test- As per sampling Plan
For Bifacial Modules, Measurement of current-voltage characteristics shall be done as per IEC TS 60904-1-2:2019 - Photovoltaic devices - Part 1-2
- II. Visual Inspection- As per sampling Plan
- III. EL Inspection-As per Sampling Plan
- IV. Electrical Characteristics (Other than Flash Test)- As per Sampling Plan

Note: The Supplier shall furnish soft and hard copy of the Production Quality Plan prior to commencement of the Inspection.

6. Sampling Process:

- a. Supplier shall provide the list of modules in a lot ready for despatch, along with flash test data (Measured Electrical Data, P_{max}) prior to commencement of Inspection tests.

Note: Smallest lot size for Inspection: 20% of the capacity as per the PO.

- b. Supplier will arrange to move the PV Modules from FG to Inspection area.
- c. Same samples shall be used for all Witness Tests stated at 5.2 above.
- d. Inspector shall commence Inspection process by randomly selecting samples from the list of serial nos. (pallet-wise) provided by Supplier as per ISO 2859: Single Sampling Plan for Normal Inspection, General Inspection plan level-I. However, the



Inspector shall reserve the right to switch to tightened or reduced level of Inspection as per the lot quality.

7. Decision Rules for Acceptance/Rejection

Following is a summary of Decision Rules for Acceptance/Rejection of a given Sample in a lot offered for Inspection:

Table 1: AQL Levels

Defect Type	AQL (%)
Major (Ma)	2.5
Minor (Mi)	4

Table 2: Inspection Levels

Inspection steps	Inspection item	Inspection level
1	Flash Test	General inspection level I
2	Visual	General inspection level I
3	EL	General inspection level I
4	EC (Other than Flash Test)	10 Nos. per lot

8. Inspection Process

a. Electrical Inspection – Flash Tests

For Electrical inspection following preparation will be done:

- Module Temp Stabilisation: Modules will be kept in controlled environmental condition till it reaches $25 \pm 2^\circ\text{C}$
- Calibration of Sun-simulator: Sun-simulator will be calibrated as per Calibration Reference. Reference should be calibrated against Calibration Reference tested from reputed testing lab TUV / Fraunhofer etc. Testing of modules will be done at STC condition, AM=1.5

Note:

- All modules selected for sampling inspection will be re-tested in the sun-simulator. A P_{\max} retest (repeatability test) variation of $\pm 2\%$ on actual flash P_{\max} value will be acceptable.



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(ii) The Supplier shall provide a valid calibration certificate of the apparatus used.

b. Visual Inspection:

- Customer representative will verify the module visual characteristics as per the Visual Acceptance norms.
- The Visual Inspection shall be carried out in a well-lit room. It shall be the responsibility of the Supplier to ensure adequate brightness in the room.

c. Electroluminescence (EL) Inspection:

- The EL image shall have sufficient resolution for analysis of defects.
- Hi-pot test shall be done as per IEC procedure. The Supplier shall provide a valid calibration certificate of the apparatus used.

9. Re-inspection and review

In case of minor non-conformities like cleaning issues, label mismatch, etc. which can be easily reworked, Supplier shall rework/replace the modules and offer them for re-inspection to Inspector.

10. Inspection Summary:

Once the inspection is completed Customer Representative will compile his Inspection Summary Report and share with Supplier and give necessary recommendation on despatch depending upon the audit findings based on the observations made. This report shall be provided within same day of inspection (Format Attached).

11. Disclaimer:

Inspection by SECI/ Employer does not absolve the responsibility of the Supplier/vendor to ensure quality during production of the material and its transport to site. Any damages during transport/ handling shall be replaced before erection at site as directed by Engineer-in-charge without any extra cost to the purchaser.



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Sampling Plan

(Sampling Plan as Per ISO 2859) -1

Table 1 - Sample size code letters (see 10.1 and 10.2)

Lot size	Special inspection levels				General inspection levels		
	S-1	S-2	S-3	S-4	I	II	III
2 to 8	A	A	A	A	A	A	B
9 to 15	A	A	A	A	A	B	C
16 to 25	A	A	B	B	B	C	D
26 to 50	A	B	B	C	C	D	E
51 to 90	B	B	C	C	C	E	F
91 to 150	B	B	C	D	D	F	G
151 to 280	B	C	D	E	E	G	H
281 to 500	B	C	D	E	F	H	J
501 to 1 200	C	C	E	F	G	J	K
1 201 to 3 200	C	D	E	G	H	K	L
3 201 to 10 000	C	D	F	G	J	L	M
10 001 to 35 000	C	D	F	H	K	M	N
35 001 to 150 000	D	E	G	J	L	N	P
150 001 to 500 000	D	E	G	J	M	P	Q
500 001 and over	D	E	H	K	N	Q	R



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(Sampling Plan as Per ISO 2859) – 2 – Normal, Tightened and Reduced)

Table 2-A — Single sampling plans for normal inspection (Master table)

Sample size code letter	Acceptance quality limit, AQL, in percent nonconforming items and nonconformities per 100 items (normal inspection)																									
	0,010	0,015	0,025	0,040	0,065	1,0	1,5	2,5	4,0	6,5	10	15	25	40	65	100	150	250	400	650	1 000					
	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re					
A	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓					
B	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓					
C	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓					
D	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓					
E	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓					
F	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓					
G	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓					
H	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓					
J	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓					
K	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓					
L	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓					
M	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓					
N	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓					
P	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓					
Q	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓					
R	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓					

↗ = Use the first sampling plan below the arrow. If sample size equals, or exceeds, lot size, carry out 100 % inspection.

↖ = Use the first sampling plan above the arrow.

Ac = Acceptance number

Re = Rejection number

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Table 2-B — Single sampling plans for tightened inspection (Master table)

Sample size code letter	Acceptance quality limit, AQL, in percent nonconforming items and nonconformities per 100 items (tightened inspection)																				1 000
	0,010	0,015	0,025	0,040	0,065	1,0	1,5	2,5	4,0	6,5	10	15	25	40	65	100	150	250	400	650	
Sample size	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	
A	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	0 1	↓	↔	↓	↓	↓	↓	↓	↓	↓	
B	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	
C	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	
D	↓	↓	↓	↓	↓	↓	↓	0 1	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	
E	↓	↓	↓	↓	↓	↓	0 1	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	
F	↓	↓	↓	↓	↓	0 1	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	
G	↓	↓	↓	↓	0 1	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	
H	↓	↓	↓	0 1	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	
J	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	
K	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	
L	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	
M	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	
N	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	
P	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	
Q	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	
R	0 1	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	
S		1 2																			

↓ = Use the first sampling plan below the arrow. If sample size equals, or exceeds, lot size, carry out 100 % inspection.

↑ = Use the first sampling plan above the arrow.

Ac = Acceptance number

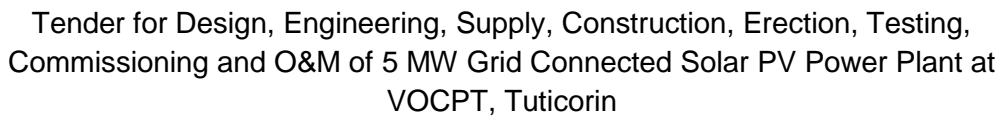
Re = Rejection number

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[illegible]

↗ = Use the first sampling plan below the arrow. If sample size equals, or exceeds, lot size, carry out 100 % inspection.

 = Use the first sampling plan above the arrow.

Ac = Acceptance number

Re = Rejection number



Tender for Design, Engineering, Supply, Construction, Erection, Testing, Commissioning and O&M of 5 MW Grid Connected Solar PV Power Plant at VOCPT, Tuticorin



Customer inspection Report

CUSTOMER INSPECTION REPORT			
Ref. No. & Date:			
Client:	PMC: SECI	EPC Contractor: PO Ref. No.:	
Place of Inspection:	Date of inspection:	Lot Size	Sample Quantity
Problem Quantity: Detail: <u>Inspection Result (OK/Not OK):</u>			
Visual Inspection Problem Quantity: Detail:			
Flash Test Problem Quantity: Detail:			
EL Inspection: Problem Quantity: Detail:			
EC Inspection (Hipot,DC Continuity,IR): Problem Quantity: Detail:			
Any Other Criteria/Remarks:			
Is the shipment qualified to be released? <input type="checkbox"/> Yes <input type="checkbox"/> No			
From Client	From EPC Contractor	Solar Energy Corporation of India Limited	

Enclosed: Test Details, Flash Test Report, EL test (images- soft copy), EC Test Report

Disclaimer: This Inspection by SECI/ Employer does not absolve the responsibility of the vendor to ensure quality during production of the material and its transport to site. Any damages during transport/ handling shall be replaced before erection at site as directed by Engineer-in-charge without any extra cost to the purchaser.

Details:

Lot :				Date
S.No.	Defect	Module Id	Type (Ma/Mi)	Details
1				
2				
....				

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	A	B	C	D	E	F	G	H	I	J	K	L	M
1	Sr.No.	Activity & Operation	Instruments	Class of Check	Type of Check	Quantum of Check	Reference Documents & Acceptance Standard	Format of Record	D* (Records identified with (√) shall be essentially included by EPC vender in QA documentation)	Cheking Agency			Remarks
2								SR - Site Register SECI-SPV-QA-F-XXX SECI-SPV-QA-T-XXX (XXX - Inspection record form No. or Test report format no.)		M'fr/ Supplier or Sub-Contractor	EPC Contractor	SECI or Owner	
3	1	General Requirements											
4	a	Availability of requisite test set-up and equipment in good working condition with valid calibration at site well before commencement of concerned activity	As required/ agreed	Critical	Physical	Once prior to start of work & Monthly there after	Tech. Specs, Construction Drawings	SR	√		x	x	Min. list of equipment - CTM, Set of Seives for CA & FA, Elcometer (digital), Micrometer, Multimeter, Meggar, Torque Wrench, Moulds for casting of concrete/ mortar test samples, Curing tank of adequate size, SS measuring tape - 50m, Theodolite, leveling staff and associated equipment etc. for day to day work with proper storage racks. The equipment shall be in adequate no. matching the site progress requirements. Functioning of laboratory equipment in proper working condition to be verified on monthly basis
5	b	Submission of QA & QC manpower deployment schedule based on agreed L-2 network	As required/ agreed	Critical	Verification	Before start of work	Tech. Specs, Construction Drawings	SR	√		x	x	
6	c	Availability of QA & QC manpower deployment based on agreed deployment schedule, Periodic review for augmentation as per actual progress	As required/ agreed	Critical	Physical	Once prior to start of work & Monthly there after	Tech. Specs, Construction Drawings	SR	√		x	x	
7	d	Submission of schedule/ programme of tests and inspection of civil works (survey, excavation, concreting, backfilling, brickwork, finishing works, roads, drains etc.) to be done monthly and quarterly based on agreed schedule	As required/ agreed	Critical	Physical	Once prior to start of work & Monthly/ Quarterly there after	Tech. Specs, Construction Drawings	SR	√	x	x	x	
8	e	Submission of actual work programme min. 3 days (72 hours) in advance to facilitate planning for quality checks as per approved QP	As required/ agreed	Critical	Physical	48 hours before start of actual work	Master programme/ schedule	SR	√	x	x	x	
9	f	Stacking and storage of construction materials and components at site	IS: 4062	Critical	Physical	Random	Tech. Specs, Construction Drawings & IS: 4062	SR	√	x	x	x	
11	2	Surveying (Execution phase)											
12	a	Availability of Calibrated Instruments, qualified & experieced staff at site	As required/ agreed	Critical	Physical	100%	Tech. Specs, Construction Drawings, Agreed deployment schedule	Calibration Report	√	x	x	x	
13	b	Ensure correct Boundary Layout and Latitude-Longitude Coordinates, True North	construction Drawings	Critical	Measurement	100%	Tech. Specs, Construction Drawings	SR	√	x	x	x	
14	c	GL (ground level), FGL (finished ground level) and Plinth Level, Check PBM(permanent bench mark) with Total Station/ Theodolite and after conformation carryout Peg marking	As required/ agreed	Critical	Measurement	100%	Construction Drawings	SR	√	x	x	x	
16	3	Materials											
17	A	Cement											
18	i	Fineness	As per IS: 4031	Critical	Review of MTC/ Physical	One test at Lab to corelate with MTC	IS:456,IS:269,IS:8112, IS:12269,IS:1489, Tech. Specs	Manufacturers Test Certificate (MTC's) and Laboratory Test results	√	x	x	x	Each consignment/ lot of cement shall be duly correlated with MTC If cement stored is more than 60 days in godown the same shall be re-tested for conformation with MTC
19	ii	Compressive Strength											
20	iii	Initial & final setting time											
21	iv	Chemical composition of Cement											
22	B	Coarse Aggregates (CA)											

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	Sr.No.	Activity & Operation	Instruments	Class of Check	Type of Check	Quantum of Check	Reference Documents & Acceptance Standard	Format of Record	D* (Records identified with (√) shall be essentially included by EPC vender in QA documentation)	Cheking Agency			Remarks
2								SR - Site Register SECI-SPV-QA-F-XXX SECI-SPV-QA-T-XXX (XXX - Inspection record form No. or Test report format no.)		M'fr/ Supplier or Sub-Contractor	EPC Contractor	SECI or Owner	
23	i	Determination of Particle size (Sieve Analysis), Flakiness index, Elongation index	As per IS: 2386	Major	Visual	Once per 100 cum or part thereof (During monsoon moisture content to be checked every day)	IS:383,IS:2386, Tech. Specs	Lab Test results	√	x	x	x	Water content of concrete to be corrected as per results of moisture content
24	ii	Moisture content		Critical		One test at Lab for each source/ on every change of source			√	x	x	x	These tests shall be carried out while establishing design mix. In case of change of source the design mix shall be re-validated for new source
25	iii	Crushing Value, Impact value, Abrasion value											
26	iv	Specific Gravity, water absorption											
27	v	Bulk Density											
28	vi	Soundness											
29	vii	Presence of deleterious materials											
30	C	Fine Aggregate (FA)											
31	i	Gradation/Determination of Particle size (Sieve Analysis)	Balance, Oven etc. As per IS: 2386, 383	Major	Visual	Gradation - Once per 1000 cum or part there of Moisture content - Every day	IS:383,IS:2386,IS:456 , Tech. Specs	Lab Test results	√	x	x	x	Water content of concrete to be corrected as per results of moisture content
32		Moisture Content		Major	Visual	One test at Lab for each source/ on every change of source							
33	ii	Specific Gravity and density (for design mix concretes only)											
34	iii	Water absorption (for design mix concretes only)											
35	iv	Presence of deleterious materials											
36	D	Concrete Admixture											
37	i	Type of admixture			Review of MTC		IS: 9103, Approved design mix	√	x	x	x	Admixture shall be of brand and type as per approved design mix. Each lot/ batch of admixurture shall accompany the Manufacturer's Brochure and shall be correlated with MTC	
38	ii	Physical & Chemical properties			Review of MTC		IS: 9103, Manufacturer's Brochure						
39	iii	Suitability											
40	E	Bricks											
41	i	Dimensional Tolerance, shape			Measurement/ Physical	As per relevant IS code/ one sample for 30,000 nos. or part there of	IS: 1077, IS: 13757, IS: 12894, Tech. Specs, Construction Drawings	Lab Test results	√	x	x	x	Efflorescence shall be checked at each source
42	ii	Compressive Strength											
43	iii	Water Absorption											
44	iv	Efflorescence											
45	E	Water											
46	i	Cleanliness - Test for ascertaining limit of solids		Major		One per 3 months for each source	IS:456,IS:3025 (part 18), Tech. Specs, Construction Drawings specification	Lab Test reports	√	x	x	x	Water to be used for concrete shall be of potable quality and shall meet requirements specified in IS: 456
47	ii	Chemical Tests to ascertain the suitability for construction purposes - pH Value, Sulphate & Chloride content					IS:456,IS:3025 (part 22, 23), Tech. Specs, Construction Drawings	Lab Test reports	√	x	x	x	
48	F	Reinforcement Steel											
49	i	Identification & Size		Major	Visual	Each batch of delivery	IS:432,IS:1786,IS:1852, Tech Specs	SR	√	x	x	x	Reinforcement steel shall be stored properly at site to avoid rusting
50	ii	Freedom from cracks, surface flaws, lamination				Random in each shift			√	x	x	x	
51	iii	Tensile Test		Critical	Review of MTC	Each batch of delivery	IS:432,IS:1566,IS:1786, Tech Specs	Manufacturers Test Certificate (MTC's)	√	x	x	x	
52	iv	Yield stress/proof stress							√	x	x	x	
53	v	Percentage Elongation							√	x	x	x	
54	vi	Bend/Rebend Test					IS:432, Tec. Specs		√	x	x	x	
55	vii	Reverse Bend Test for HDS wire							√	x	x	x	
57	3	Structural Steel Work {Example: Chequered plate cover, Panel supports, Rungs, Cat ladder, Inserts, Fencing gate (MS) etc.}											
58	i	Strutural Steel (Raw material)-Chemical Properties, Ultimate Tensile Strength(UTS), Yield Strength (YS), Percentage Elongation, Bend test		Critical	Review of MTC	For each batch of each section	IS: 2062, IS: 8500, Tech. Specs, Construction Drawings	Manufacturers Test Certificate (MTC's)	√	x	x	x	MTC to be correlated
59	ii	Dimensional Check - Secition dimensions, thickness		Critical	Measurement	10% of total quantity at Random			√	x	x	x	For Fencing gate - dimensional check 100%

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2								SR - Site Register SECI-SPV-QA-F-XXX SECI-SPV-QA-T-XXX (XXX - Inspection record form No. or Test report format no.)		M'fr/ Supplier or Sub-Contractor	EPC Contractor	SECI or Owner	
60	iii	Visual checks for damages, rusting, pitting, scaling etc.		Major	Visual	100%	IS: 822, Tech. Specs, Construction Drawings, MTC, relevant BIS standards for painting	Manufacturers Test Certificate (MTC's)/ SR	√	x	x	x	
61	iv	Visual checks for welding defects, painting (surface preparation, primer coat, and Finishing coat - make and shade of paint, DFT) as applicable.		Major	Visual/ Measurement/ Review of MTC	10% of total quanity at Random			√	x	x	x	MTC to be correlated
62	v	Acceptance ofStructural steel works		Major	Physical/ Acceptance	Random	Tech. Specs, Construction Drawings	SR	√	x	x	x	
64	4	Foundation System											
65	A	Bored Cast in-situ Concrete Piling (for MMS support)											
66	a	Execution											
67	i	Ensuring correctness of layout		Critical	Physical	100%	Tech. Specs, Construction Drawings	SR	√	x	x	x	1. During boring of pile, record SPT/ core recovery to ensure socketing length in the hard strata equivalent in terms of pile diameter in hard rock zone as per tech Specs and approved construction drawings. 2. In case of collapse of pile bore during drilling temporary MS lining shall be used. 3. Lines and levels to be checked 4. Each bore shall be cleaned of any loose materail by pressure jet washing/ cleaning by air jet 5.The column section shall pe placed and held in position in true vertical alignment using template/ tripod till initial setting of concrete 6. Concrete garde - as per Construction Drawing
68	ii	Checking of pile making as per drawing	Total Station	Major	Vsual								
69	iii	Checking of Centre line of Pile Group	Total Station	Critical	Physical								
70	iv	Check Pile Location	Total Station		Measurement								
71	v	GL, Pile depth, diameter and alignment	As required	Major			Visual						
72	vi	Cleaning/ flushing of pile bore	As required										
73	vii	Insertion & positioning of Column post in the bore hole (in case of embeded col. Leg) Placement of reinforcement and foundation bolts with template (inacse of fixing of col. with base plate & foundation bolt assembly)	As required	Critical	Visual/ Measurement								
74	viii	Acceptance of Pile casting - Shape, reinforcement or col. leg embedment (as aplicable), concreting, compacting with use of needle vibrator etc.	As required/ Agreed	Major	Visual								
75	ix	Grouting u/s of base plate	As required/ Agreed	Critical	Visual	100%	Tech. Specs & Construction drawings	SR	√	x	x	x	The type, grade and thickness of grout shall be as per approved drawing
76	b	Testing											
77	i	Initial pile load test - Compression (Vertical), Lateral (Horizontal), & Pull out (Tension)	Calibrated dial gauges, jack of required capacity, datum bars etc.	Critical	Physical	100% for 3 no. for each type of test or as specified in Tech Specs, Approved test pile layout	IS 2911, Tech Specs, Construction Drawings	Test Report	√	x	x	x	1. The R/F details shall be as per approved drawing for test plie (if applicable), 2. The test load shall be up to 2.5 times of required pile capacity in case of Compression and Lateral load and 2 times in case of Pull out test as per IS: 2911 (Pt. 4), 3. The location shall be as per approved pile test programme/ layout drawing 4. The test shall be carried out as per approved methodology 5. Test report along with test records shall be submitted in standard format as per IS:2911
78	ii	Routine pile tests - Pull out and Lateral		Critical	Physical	100% for 0.5% of total no. of working piles for each type of test	IS 2911, Tech Specs, Construction Drawings	Test Report					1. The piles for routine tests shall be selected at Random to represent total no. of job piles insalled 2. The test load for vertical and pull out shall be 1.5 times the required pile capacity 3. The test shall be carried out as per approved methodology. 4. The Test report along with test records shall be submitted in standard format as per IS:2971 (Pt. 4)

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80	B	Cable Trench/ Building & Equipment Foundations											
81	a	Before Excavation											
82	i	Ensuring correctness of layout		Critical	Physical	100%	Tech. Specs, Construction Drawings	SR	√	x	x	x	
83	ii	Checking of trench marking & alignment		Major	Visual		Tech Specs, Construction Drawings						
84	b	Excavation											
85	i	Dimensional conformity including diagonal check		Critical	Visual / Measurement	100%	IS:3764, Tech Specs, Construction Drawings	SR	√	x	x	x	
86	ii	Excavated earth kept away from edges		Minor	Visual	Random		SR	√	x	x	x	
87	c	Acceptance of Trench/ Foundation casting - Shape, reinforcement, shuttering, concreting, etc.		Minor	Physical	100%	Tech. Specs, Construction Drawings	SR	√	x	x	x	
89	5	Foundation Bolts / Inserts/ Concrete embedments											
90	i	Visual check of mechanical damage and galvanising painting if applicable on inserts			Visual / Measurement	100%	As per Tech Specs, Construction Drawings	SR	√	x	x	x	
91	ii	Bolt and assecories, inserts - Dimensions (total & threaded length & dia of bolt, size & thk of embedment and lugs etc.), Nos											
92	iii	Verticality, alignment, levels, pitch distance, embeded and projected length of bolt											
93	iii	Use of template for Alignment and Level checking											
94	iv	Acceptance of foundation bolt assembly / inserts in postion											
96	6	Formwork											
97	i	Materials & Accessories	As agreed/ required	Major	Visual	Once before start of work	IS :456 , Other relevant BIS Standard, Tech. Specs, Construction Drawings	SR	√	x	x	x	
98	ii	Soundness of staging, shuttering and scaffolding including application of mould oil/ release agent	As agreed/ required	Major	Visual	Once before start of work	Manufacturer's specs, IS :3096, IS:4014, IS: 4990, Tech. Specs, Construction Drawings	SR	√	x	x	x	
99	iii	Dimensional Check, alignment & levels as per drawing and tolerences		Major	Visual/ Measurement	100%	Tech. Specs, Construction Drawings	SR	√	x	x	x	
100	iv	Proper sealing of joints, Acceptance of formwork before concreting		Major	Physical/ Visual	Before start of concreting	As per provisions, tolerences, Tech. Specs, Construction drawings		√	x	x	x	
102	7	Placement of Reienforcement Steel											
103	i	Check whether Bar bending schedule (BBS) with necessary lap, spacers & chairs is available before start of cutting & bending of bars	As agreed/ required	Major	Visual/ physical	Random in each shift at each work site	Tech. Specs, Construction Drawings, IS: 2502	SR	√	x	x	x	
104	ii	Check whether cutting and bending of bars is as per BBS and placement conforms construction drawings			Visual/ measurement								
105	iii	Check whether all joints and crossing of bars are tied properly with right gauge and annealed wire			Visual								

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106	iv	Check for proper cover,spacing of bars, spacers & chairs after the reinforcement cage has been put inside the foundation			Visual								
107	v	Check whether lapping of bars are tied properly with right gauge and annealed wire			Visual								
109	8	Concrete											
110	i	Availability of approved Design Mix (for all specified grades)		Critical	Physical	For each specified grade of concrete	IS :456, Tech Specs, Construction Drawings	Approved mix design	√		x	x	The concrete shall be as per approved design mix and the materials (cement, coarse and fine aggregate shall be from the same source considered during mix trials. The mix design shall be verified and approved in case of change of source of any of the matearials
111	ii	Minimum cement content (as applicable in MMS piling and foundation/ below ground works)		Critical	Physical	For piling and foundation works	IS: 456, Tech. specs, Construction drawings	SR	√		x	x	The minimum cement content shall correspond to exposure conditions and/ or, suplhate contents in ground water/ soil
112	iii	Trial mixes to ascertain the workability and cube strength	As per recommended mix design from specialist agency	Critical	Physical/ Testing	One for each mix proportion	Tech. Specs, IS: 456	Lab Test Reports	√	x	x	x	Necessary correction for moisture content and water absoption according to mix design recommendations may be carried out during trial mix
113	iv	Mixing of concrete- check for quanities of cement, CA, FA and water used, Concrete shall be homogenous	Mixing shall be done in a approved mixer/ batching plant (conforming to IS: 4926/ 4925)	Major	Physical	Mixer/ Batchter to be calibrated at the time of starting and subsequently once in tree months	IS: 4925, IS: 4926	Calibration Report/ Certificate	√	x	x	x	Review of calibration chart/ Certificate as per IS: 4926 Qty. of materials including cement consumptionshall be available through on line printer
114	v	Handling & trasportation	As required	Major	Physical	100%	As per approved/ agreed construction methodology	SR		x	x	x	Concrete shall be placed within 30 minutes of its removal from mixer
115	vi	Placement of concrete	As required	Major	Visual/ Physical	100%			√	x	x	x	
116	vii	Compacting	As required	Major	Physical	At Random			√	x	x	x	
117	viii	Curing	As required	major	Physical	At Random	IS: 456	SR		x	x	x	
119	9	Concrete Testing & Acceptance											
120	i	Workability - Slump Test		Critical	Physical	At the time of concrete pouring at site every 2 hrs	IS:456, IS:516,IS:1199, Tech Specs, Construction Drawings	Test Results / SR	√	x	x	x	
121	ii	Crushing strength - (Works test cubes)		Critical	Physical	Testing	IS:456, IS:516,IS:1199, Tech Specs, Construction Drawings	Test Results/ SR	√	x	x	x	MMS Pile - 6 cubes (3 for 7 day test & 3 for 28 day strength) per sample for each 5 cum or part there off Building work and Equipment/ Misc foundations etc. - 6 cubes (3 for 7 day test & 3 for 28 day strength) per sample for each 25 cum or part there off
122	iii	Acceptance of concrete work - Dimensional check (dimensions, levels etc), placement of bolts, inserts, pockets, pitch distance for bolts etc.	As required & dimensional tolerences	Major	Visual/ Measurement	100%		Joint Protocol between Civil Conractor, EPC Vendor and SECI/ Owner where applicable/ SR	√	x	x	x	
124	10	Acceptance of Hardened Concrete											
125	i	Dimensional check (dimensions, levels etc), workmanship, finishing after removal of shuttering	As required & dimensional tolerences	Major	Visual/ Measurement	At Random			√	x	x	x	

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								SR - Site Register SECI-SPV-QA-F-XXX SECI-SPV-QA-T-XXX (XXX - Inspection record form No. or Test report format no.)		M'fr/ Supplier or Sub-Contractor	EPC Contractor	SECI or Owner	
126	ii	Water tightness test for liquid retaining structures/ tanks	As required	Critical	Physical/ Testing	100%	IS: 3370 (Pt.4), Tech Specs, Construction Drawings	SR/ Test Records	√	x	x	x	Water tightness test shall be performed for Under ground (UG) water tank, Septic tank
128	11	Excavation & filling in foundations, trenches, plinth & grading works											
129		Excavation											
130		Nature, Type of soil/ rock before and during excavation		Major	Visual	Random in each shift	Tech. Specs., Construction Drawings	SR		x	x	x	
131		Initial GL before start of excavation		Major	Measurement	100%		SR	√	x	x	x	
132		Final shape/ size & dimensions of excavation		Major	Measurement	100%		SR	√	x	x	x	
133		Final excavation levels		Major	Measurement	100%		SR	√	x	x	x	
134		Side slope of final excavation		Major	Measurement	Random in each shift		SR		x	x	x	
135	12	Fill / Backfill											
136	i	Suitability of borrowed earth for filling (if applicable) - Grain size analysis, Atterberg limits, Free swell index, Organic matter		Major	Physical	One in every 2000 cum or part there of for each type and source of fill material subject to min. 2 samples	IS: 2720 (Pt. IV), IS: 2720 (Pt. XI), Tech Specs, Construction Drawings	Lab Test Results/ SR	√	x	x	x	The parameter should not be worse than the parameter of the existing soil in plant area
137	ii	Optimum moisture content (OMC), Max. dry density (MDD) before fill		Critical	Visual	At Random	IS: 2720 (Pt. I), IS: 2720 (Pt.VII), Tech Specs, Construction Drawings	Lab Test Results/ SR	√	x	x	x	
138	iii	Layer thickness, Compaction procedure		Major	Visual	At Random	Approved Methodology, Tech. Specs, Construction Drawings	SR	√	x	x	x	The layer thickness, Type & Capacity of roller, No. of passes shall be as per approved methodology, Construction Drawing, Tech. Specs
139	iv	Degree of compaction - 1. Dry density by proctor needle penetration 2. Earth filling - In-situ Dry density (core cutter or sand replacement method) or Sand Filling - In-situ Relative density (Density Index)		Critical	Physical	(i) For foundation fill/ backfill - One for every 10 foundations at Random for each compacted layer (ii) For area grading/ filling - one every 1000 sqm area for each compacted layer	IS: 2720 (Pt. XXIX), IS: 2720 (Pt. XXVIII), IS: 2720 (Pt. XIV), Tech Specs, Construction Drawings	Test Results/ SR	√	x	x	x	
141	13	Brick masonry work											
142	i	Soaking of Bricks before use		Major	Physical	100%	IS: 2250	SR		x	x	x	
143	ii	Grading of sand, Mortar mix / proportion, Compressive strength, Consistency		Major	Physical/ Test	At Random	IS: 2250, IS: 2116, Tech Specs, Construction Drawings / As per Design Specification	Lab Test Results/ SR		x	x	x	The sand grading shall conform to IS: 2116
144	iii	Workmanship, Verticality (Plumb) / Alignment		Major	Physical/ Measurement	100%	IS: 2212, IS: 1905, Tech Specs, Construction Drawings	SR	√	x	x	x	
145	iv	Check for Bond/closers, joints		Major	Visual	At Random	IS: 2250	SR		x	x	x	
146	v	Curing		Major	Visual	100%	IS: 2250 / As perTech. Specification	SR		x	x	x	
148	12	Cement Plaster											

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1										M'fr/ Supplier or Sub-Contractor	EPC Contractor	SECI or Owner	
2								SR - Site Register SECI-SPV-QA-F-XXX SECI-SPV-QA-T-XXX (XXX - Inspection record form No. or Test report format no.)					
149	i	Quality & Grading of sand, Check for mix proportion, wetting the surface etc		Major	Physical	At Random	IS: 2116, IS: 2386 (Pt. I & II), IS: 1542, Tech Specs	Lab Test Results/ SR		x	x	x	Sand to be used shall be free from deleteriousmaterials, Grading shall conform to Table-I of IS: 2116
150	ii	Plaster & grooves - Thickness, Evenness & Finishing, Trueness os palstering system		Major	Visual/ Measurement	At Random in each shift	Tech Specifications, Construction Drawings	SR	√	x	x	x	Trueness - Deviation not more than 4mm when checked with straight edge of 2m length
151	iii	Hacking, Raking of joints, Cleaning the surface, Removing all loose particles, Wetting the surface etc		Major	Visual	At Random in each shift	IS 1661, Tech Specs	SR		x	x	x	
152	iv	Curing		Minor	Physical	100%	IS 1661, Tech Specs	SR		x	x	x	
154	14	Painting System - Plastered Masonry & Concrete surface											
155	i	Materials & accessories - Approval for Paint, Color shade and Brand- Dry distemper, Oil Bound Distemper, Acrylic Emulsion, Chemical resistant, Oil resistant Paint, Weather proof acrylic exterior paint, water proof cement paint etc.	As approved by SECI/ Owner	Critical	Review of MTC	Each batch of delivery	Tech Specs, Construction Drawings	MTC/ SR	√	x	x	x	MTC shall be correlated with the material received
156	ii	Surface preparation	As required	Minor	Physical	Random in each shift	IS: 2935 (Pt.1), Tech Specs, Construction Drawings	SR	x	x	x	x	
157	iii	Number of coats	As required	Major	Physical	Random in each shift	Tech Specs, Construction Drawings	SR	x	x	x	x	
158	iv	Application and Acceptance of painted surface	As required	Major	Physical	Each surface at Random							
160	15	Floor finishes & Allied works											
161	i	Preperation of Sub-grade			Physical	At Random for each building	Tech. Specs, Construction Drawings	SR	√	x	x	x	
162	ii	Plinth filling in layers (stone aggregates/ rubble with interstices filled with sand), ramming & compaction			Physical	At Random for each building	IS: 2720, Tech. Specs, Construction Drawings		√	x	x	x	Quality Checks as aplicable to Fill/ Back fill
163	iii	Check providing shuttering, reinforcement (if applicable)			Physical	At Random for each building	Tech. Specs, Construcion Drawings			x	x	x	Quality Checks as aplicable to Shuttering/ Reinforcement placement
164	iv	Checking the Panel size (as applicable)			Physical	At Random for each building	IS: 5491, Tech. Specs, Construcion Drawings			x	x	x	The concrete shall be cast in alternate panels in chess board fashion, panel size as specified in Construction Drawing or 25 sqm
165	v	Availability of Design mix (if applicable)			Visual	At Random for each building	Tech. Specs, Construcion Drawings	Mix Design Report/ SR		x	x	x	
166	vi	Clearance for concreting (as applicable)			Physical	100%	Tech. Specs, Construction Drawings	Joint Protocol between Civil Contractor, Eqpt. Supplier/ EPC Vendor & SECI/ Owner SR		x	x	x	
167	viii	Performing concreting ensuring Grade/Mix Proportions, Compaction, Thickness and Finish			Physical	At Random per shift	IS; 456, Tech. Specs, Construction Drawings	SR	√	x	x	x	Quality Checks as aplicabel to Concrete Work
168	viii	Curing			Visual	100%	IS: 456, Tech. Specs	SR		x	x	x	Minimum up to 10 days from date of casting
169	ix	Testing of Concrete Cubes for Flooring			Physical	One sample for every 20 Cum of concreting or part thereof for each days concreting (one sample consists of min 3 test cubes for 28 days strength)	IS:456, IS:516,IS:1199 and Design specification	Lab Test Reports					
170	x	Tiled flooring/ dado											

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1													
2								SR - Site Register SECI-SPV-QA-F-XXX SECI-SPV-QA-T-XXX (XXX - Inspection record form No. or Test report format no.)		M'fr/ Supplier or Sub-Contractor	EPC Contractor	SECI or Owner	
171	a	Material - Glazed ceramic Tiles, Vitrified Ceramic Tiles, Mosaic Tiles, Acid alkali Tiles, Heavy duty cement concrete tiles	As agreed/ required	Critical	Review of MTC & Test Reports	Each lot of material received	IS:13755, IS:1237, IS:8042, Tech Specs, Construction Drawings	MTC/ SR	√	x	x	x	MTC shall be correlated for all the parameters specified in Tech. Specs, BIS Standard
172	b	Finishing & Acceptance		Major	Physical	100%	IS: 1443, Tech Specs, Construction Drawings						
173	xi	IPS with or without IRONITE (as applicable)		Major	Physical	At Random per shift	IS: 5491, Tech. Specs, Construction Drawings	SR	√	x	x	x	
174	xi	Fixing of Panel Dividers for finishing course (3 mm Thk Glass/ 2mm Thk Aluminium strip) (if applicable)		Major	Physical	At Random per shift	Tech Specs, Construction Drawings	SR	√	x	x	x	
175	xii	Anti abrasion/ anti wearing epoxy coating (if applicable)											
176	a	Material	As agreed/ required	Critical	Approved Make and Type	Each lot of material received	Tech Specs, Construction Drawings, Manufacturer's Brochure/ Recommendations	manufacturer's Brochure/ SR	√	x	x	x	Material specifications to be correlated with Manufacturer's Brochure
177	b	Finishing & Acceptance		Major	Physical	100%	Tech Specs, Construction Drawings	SR	√	x	x	x	
178	xiv	Kota stone flooring and skirting (as applicable)											
179	a	Material	Quality, Texture, Thickness, Colour fro approved source	Major	Physical	Each batch of delivery	Tech Specs, Construction Drawings	SR	√	x	x	x	
180	b	Finishing & Acceptance		Major	Physical	100%	Tech Specs, Cosntruction Drawings	SR	√	x	x	x	
181	xv	Acid/ Alkali resistant tile flooring/ dado											
182	a	Material -Tiles, Mortar, Sealing, Fillers etc.	Thickness, Quality,	Critical	Approved source, Review of MTC/ Test Report	Each batch of delivery	Tech Specs, Construction Drawings	SR	√	x	x	x	The acid alkali resistant tile flooring nd dado shall be provided in battery room as per approved Arch finishing details
183	b	Finishing & Acceptance	Workmanship	Major	Physical	100%	Tech Specs, Construction Drawings	SR	√	x	x	x	
184	xvi	Interlocking Blocks											
185	a	Materials	Size/ Shape, colour shade, Grade of Concrete	Critical	Approved source, Review of MTC/ Test Report	Each batch of delivery	BS: 6717, Tech Specs, Construction Drawings	SR	√	x	x	x	
186	b	Final finishing & Acceptance	As agreed/ required	Major	Physical	100%	BS: 7533 (Pt.3), Tech Specs, Construction Drawings	SR	√	x	x	x	
188	16	Damp Proof Course											
189	i	Material - Hot bitumen & water proofing materials etc.	As agreed/ required	Critical	Review of MTC	Each batch of delivery	IS: 702, Tech. Specs, Cosntruction Drawings	SR	√	x	x	x	
190	ii	Acceptance of Damp Proof Course - Thickness, Grade of PCC, Application of Bitumen layer etc.	As agreed/ required	Major		100%	Tech Specs, Construction Drawings	SR	√	x	x	x	
192	17	Grouting of pockets/ underside of base plate											
193	i	Material	As required/ Agreed	Critical	Review of MTC/ Physical	Each batch of delivery	Tech. specs, Construction Drawings, Manufacturerr's catalogue	SR	√	x	x	x	In case of ready mixed grout MTC to be correlated with Manufacturerr's catalogue
194	ii	Type of Mix	Anti shrink cement grout/ Ready mixed - Fluid mix, stiff mix as required	Major	Physical	At Random prr shift of grout application	Tech. specs, Construction Drawings	SR	√	x	x	x	In case of cement grout anti shrink compound shall be added as per provisions of relevant IS/ Cosntruction Drawing
195	iii	Mixing, placement, application	As required	Major	Visual	At Random prr shift of grout application	Tech. Specs, Construction Drawings	SR	√	x	x	x	
196	iv	Crushing Strength - Test cubes	As required	Major	Physical/ Testing	3 cubes for entire grouting work	IS: 4031 (Pt.6), Tech Specs, Construction Drawings	SR/ Lab Test Report	√	x	x	x	

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197	v	Acceptance of Grouting	Thickness, Finished level etc.	Major	Physical	100% of 20 % of grout work at Random	Tech. Specs, Construction Drawings	SR	√	x	x	x	
199	18	Precast Concrete											
200	a	Bought Out Units (Precast boundary wall units - Slab Panels, Column etc., Trench Covers , Manhole Covers, Paver Blocks etc.)											
201	i	Crushing strength	As required	Critical	Review of MTC/ Test Reports	100% for Each batch of delivery	IS: 456, IS:516, IS: 1199, Tech Specs, Construction Drawings	MTC	√	x	x	x	Sampling as per IS: 456, Vendor record review
202	ii	Workmanship, dimentions, R/F	As require/ agreed	Major	Review of MTC/ Physical	Each batch of delivery at Random	Tech Specs, Construction Drawings	MTC/ SR	√	x	x	x	Vendor record review, Physical check at Random
203	b	Cast at site (if applicable)											
204	i	Crushing strength - Test Cubes	As required	Critical	Testing		IS: 456, IS:516, IS: 1199, Tech Specs, Construction Drawings	SR	√	x	x	x	1 sample of 6 cubes (3 for 7 days strength, 3 for 28 days strength) for each 5 cum of concrete with minimum 1 sample per shift of concrete work
205	ii	Workmanship, dimentions, R/F	As required/ agreed	Major	Physical	At Random	Tech Specs, Construction Drawings	SR		x	x	x	
206	c	Acceptance of pre-cast concrete units											
207	i	Bought Out Units - Check for any breakage, damage during handing & trasport, erection at site (levels) etc.	As required/ Agreed	Major	Visual	At Random	Tech Specs, Construction Drawings	SR	√	x	x	x	
208	ii	Cast at site (if applicable) - Check for curing, damage during handling, erection at site (level) etc.	As required/ Agreed	Major	Visual	100% of 10% at Random	Tech Specs, Construction Drawings	SR	√	x	x	x	
210	19	Joints In concrete											
211	i	Joint Material - Bitumen inpregnataed fiber board, PVC water stop, Sealing compound - Bitumastic/ polysulphide, Hydrophilic strip, Expanded polysterene (thermocol) board etc.	As per manufacturer's standards	Critical	Review of MTC	Each batch of delivery	Tech. Specs, Construction Drawings, IS: 1838, IS:1834, IS:2200	MTC	√	x	x	x	
212	ii	Acceptance of installation	As agreed/ required	Major	Physical	Each installation at Random	Tech. Specs and Construction Drawings	SR	√	x	x	x	
214	20	Underdeck Insulation Works											
215	i	Insulation material - Mineral/ Glass wool, galvanized wire neting, Aluminium foil, fasteners etc.	As agreed/ required	Critical	Review of MTC/ Test Reports	Each lot received at site	Tech. Specs and Construction Drawings	MTC/ Test Reports/ SR	√	x	x	x	All tests as per Tech. Specifications
216	ii	Acceptance of installation	As agreed/ required	Major	Physical	Each installation	Tech. Specs and Construction Drawings	SR	√	x	x	x	
218	21	False Ceiling											
219	i	Materials - Gypsum board/ Tiles, Particle board tiles, Al tiles/ Strips, GI hangers, AL/ GI Tee support, AL/ GI Edge angle, Fasteners etc.	As agreed/ required	Critical	Visual/ Physical, Review of MTC	Each lot received at site	IS:2095, IS:8183, Tech. Specs and Construction Drawings	MTC/ SR	√	x	x	x	Compare MTC with Tech. Specifications and requirements
220	ii	Acceptance of Installation	As agreed/ required	Major	Visual/ Physical	Random	Tech. Specs and Construction Drawings	SR		x	x	x	
222	22	Doors, Windows, Ventilators, Glass/ Glazing and Grill											

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223	i	Door Frame (Hollow steel metal, Aluminium, Wooden etc. including fittings such as hold fasts etc.)	As agreed/ required	Critical	Visual, Physical, Review of MTC/ Test Reports	Each lot received at site	Tech. Specs and Construction Drawings	MTC/ Lab Test Reports/ SR	√	x	x	x	
224	a	Steel Doors											
225	i	Materials (MS sheet & Stiffeners, fasteners, hinges, jambs, lock strike plate, hydraulic door closer, fittings and fixtures etc)	As agreed/ required	Critical	Visual/ Physical/ Review of MTC, Test Report	Each lot received at site	IS:2062, Tech. Specs and Construction Drawings	MTC/ Lab Test Report/ SR	√	x	x	x	Review of MTC/ Test Report
226	ii	Finishing & Acceptance - Surface preperation for painting, primer & finishing coat, DFT	As agreed/ required	Major	Visual/ Physical	Random	Tech. Specs and Construction Drawings	SR	√	x	x	x	
227	b	Flush Doors											
228	i	Shutters, Teak beading	As agreed/ required	Critical	Review of MTC/ Test Report	Each lot received at site	IS:2202, Tech. Specs and Cosntruction Drawings	MTC/ Lab Test Report/ SR	√	x	x	x	
229	ii	Acceptance	As agreed/ required	Major	Visual/ Physical	Random	Tech. Specs and Construction Drawings	SR		x	x	x	
230	c	Aluminium doors and Partition works											
231	i	Materials- Aluminium sections (average thickness, alkali resistant, anodisation, power coating and colour shade etc.), fittings and fixtures. floor spring, hydraulic door closer, hinges, etc.	As agreed/ required	Critical	Visual/ Physical/ Review of Test Report	Each lot received at site	IS:1948, IS:1949, IS:733, IS:1285, IS:1868, IS:11857, Tech. Specs and Construction Drawings	SR/ Lab Test Reports	√	x	x	x	Review of Test Report For anodization check as per Tech. Specs and Construction Drawings Power coating, colour shade as applicable as per Tech. Specs and Construction Drawings
232	ii	Finishing & Acceptance - fabrication & erection, fitting etc..	As agreed/ required	Major	Visual/ Physical	Random	Tech. Specs and Construction Drawings	SR		x	x	x	
233	d	Grill											
234	i	Materials - Aluminium, MS, Anodization in case of aluminium	As agreed/ required	Critical	Visual/Physical/ Review of Test Report	Each lot received at site	Tech. Specs and Construction Drawings	SR/ Lab Test Reports	√	x	x	x	Review of Test Reports
235	ii	Finishing & Acceptance - erection, fitting, painting in case of MS grill etc.	As agreed/ required	Major	Visual/ Physical	Random	Tech. Specs and Construction Drawings	SR		x	x	x	
236	e	Rolling Shutters											
237	i	Surface finish, Thickness of plate, mechanically operated	As agreed/ required	Critical	Visual/ Physical/ review of MTC	Random for each lot of delivery	IS:8248, Tech. Specs & Construction Drawings	SR	√	x	x	x	
238	ii	Finishing and Acceptance -Painting , DFT	As agreed/ required	Major	Visual/ Physical	Random	Tech. Specs and Construction Drawings	SR		x	x	x	
239	f	Glass and Glazing											
240	i	Material - Clear float glass, wired glass, tinted glass, ground glass, figured glass, thickness	As agreed/ required	Major	Review of MTC/ test reports	For each lot received at site	IS: 14900, IS:1081, IS: 3548, IS:5437 Tech Specs and Construction Drawings	SR	√	x	x	x	
241	ii	Installation, finishing and acceptance	As agreed/ required	Major	Visual/ Physical	Random	Tech Specs and Construction Drawings	SR	√	x	x	x	
243	23	Precast Concrete Boundary Wall											
244		Acceptance of boundary wall- Finising, Alignment Dimensions etc.	As agreed/ required	Major	Physical		Tech Specs and Construction Drawings	SR		x	x	x	For inspection of precast concrte units -refer S.No. 18
246	24	Roof Water Proofing											
247	i	Methodology for the application of water proofing system	As required	Critical	Review	for each type of treatment	Tech Specs and Const. Drawings						
248	a	Materials											

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249	i	Polyurethane based coating, polyester scrim cloth, extruded HD dimpled polyurethane	As agreed / required	Critical	Review of MTC/ test reports	For each lot received at site	ASTM C-836, ASTM C898 and Tech Specs /Const. Drawings	MTC/ SR	√				
250	b	Roof											
251	i	Graded under bed - Slope/ Level	As agreed / required	Major	Physical	100%	Tech Specs and Construction Drawings	SR		x	x	x	
252	ii	Elastomeric coatings -Primer coat, Finishing coat	As agreed / required	Major	Review of MTC/ test reports	Each lot of delivery	Tech Specs and Construction Drawings	MTC/ Test Reports/ SR	√	x	x	x	
253	iii	Wearing Course - PCC-Grade, chicken wire mesh, elastomeric sealant	As agreed / required	Major	Visual/ Review of MTC	Each lot of delivery of material/ Review of Test Report	Tech Specs and Construction Drawings	MTC/ Test Reports SR	√	x	x	x	2 samples of 3 no. of test cube each shall be taken for PPC work for testing of crushing strength of concrete mix, Review of MTC for Chicken wire mesh, waterproof sealant
254	c	Acceptance of Water proofing treatment	As agreed/ required	Major	Visual/ Physical	100%	Tech Specs and Construction Drawings	SR		x	x	x	
256	25	Water Supply and Sanitary Installations											
257	a	Water Supply Fittings and Fixtures											
258	i	Materials - GI/ MS/ C-PVC/ uPVC/PPR/HDPE pipes and fittings	As agreed / required	Critical	Review of MTC/ test reports	Each lot of delivery as per Specifications	IS:1239, IS:4736, IS:4985, IS:6745, IS: 4984, IS:2633, IS:2629, IS:15778, IS:15801, Tech Specs and Construction Drawings	MTC/ SR	√	x	x	x	
259	ii	Disinfection - Before use	As agreed / required	Major	Physical	Each installation	IS:2065, Tech specs and construction Drawings	SR		x	x	x	
260	iii	Hydraulic test - Before use/ Leakage	As agreed / required	Critical	Physical	Each installation	Tech Specs and Construction Drawings	SR		x	x	x	
261	iv	Acceptance & Working	As agreed / required	Major	Physical	Random	Tech Specs and Construction Drawings	SR		x	x	x	
262	b	Sand Cast Iron/ Cast iron Pipes											
263	i	Material - SCI / CI pipes and fittings / joints	As agreed / required	Critical	Review of MTC/ test reports	Each lot of delivery (as applicable)	IS: 1729, IS:1536, IS:1538, Tech Specs and Construction Drawings	MTC/ SR	√	x	x	x	
264	ii	Acceptance and leakage	As agreed / required	Major	Physical	Random	Tech Specs and Construction Drawings	SR		x	x	x	
265	c	HDPE Pipes for Sewerage											
266	i	Material- HDPE pipes and fittings/ joints	As agreed/ required	Critical	Review of MTC/ test reports	Each lot of delivery (as applicable)	IS:14333, Tech. Specs	MTC/SR	√	x	x	x	
267	ii	Acceptance & leakage	As agreed / required	Major	Physical	Random	Tech Specs and Const. Drawings	SR		x	x	x	
268	d	HDPE Pipes for Rain water Downcommer											
269	i	HDPE pipes and fittings/ joints	As agreed/ required	Critical	Review of MTC/ test reports		IS:4984, Tech. Specs	MTC/SR	√	x	x	x	
270	ii	Acceptance & leakage	As agreed / required	Major	Physical	Random	Tech Specs and Const. Drawings	SR		x	x	x	
271	e	Sanitary fitting and fixtures											
272	i	Sanitary items and fixtures i.e. water closets, urinals, wash basins, sinks, mirrors, shelves, towel rail, soap containers, geyser, water cooler, etc, water supply / sanitation pipes, manhole cover and frames etc	As agreed / required	Major	Review of MTC/ Test reports	Each lot of delivery as per Specifications	Tech Specs and Const. Drawings	MTC/Test Reports/ SR	√	x	x	x	

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273	ii	Acceptance of installations of all sanitary items and fixtures	As agreed / required	Major	Acceptance	100%	Tech Specs and Const. Drawings	SR		x	x	x	
274	f	RCC Pipes											
275	i	Material - RCC pipes	As agreed / required	Major	Review of MTC/ test reports	Each lot of delivery as per Specifications	IS: 458, Tech Specs and Const. Drawings	MTC/Test Reports/ SR	√	x	x	x	
276	ii	Acceptance and leakage	As agreed / required	Major	Physical	Random	Tech Specs and Const. Drawings	SR		x	x	x	
277	g	Water Storage Tank											
278	i	Over head / loft type	As agreed / required	Critical	Physical, review of MTC/ test reports	Each lot of delivery as per Specifications	IS:12701, Tech Specs and Const. Drawings	MTC/Test Reports/ SR	√	x	x	x	
279	ii	Aceptance and leakage	As agreed / required	Major	Acceptance	Random	IS:12701, Tech Specs and Const. Drawings	SR		x	x	x	
280													
281	26	Special Items (Switch Yard)											
282	a	Earthing Mat (Grounding System)											
283	i	Earthing mat	As agreed / required	Critical	Physical, review of MTC/ test reports	Each lot of delivery as per Specifications	As per relevant IS and Tech. Specs / Manufacturer's, IS 3043	SR/MTC	√	x	x	x	
284	ii	Weld sizes & length	Visual/Tape	Major	Visual/ Measurement	100%	Tech Specs and Const. Drawings	SR		x	x	x	Low hydrogen electrode as per approval shall be used.
285	iii	D P test	DP test Kit	Critical	Physical	10% at random	Tech Specs and Const. Drawings	TR	√	x	x	x	
286	iv	Earth test	Earthing test kit	Critical	Physical	100%	IS:3043, Tech Specs and Const. Drawings, Relevant IS 3043	SR/ Test Report	√	x	x	x	
287	b	Anti Weed Treatment											
288	i	Anti-weed treatment materials	As agreed / required	Critical	Physical, review of MTC	Each batch of delivery	Tech Specs and Const. Drawings	SR/ MTC	√	x	x	x	
289	ii	Execution of treatment	As agreed / required	Major	Physical	Random check for each treatment	Tech Specs and Const. Drawings	SR		x	x	x	
291	27	Road Work											
292	a	Construction of Sub-Grade and earthen/hard soulders											
293	i	Standard proctor Test	As per IS: 2720	Critical	Physical	One in every 2000 cum for each type and source of fill materials	As per Tech Specs and Const. Drawings,Section 900 of MORTH specification, IS 2720 (Pt.VII)	SR	√	x	x	x	In cutting or existing levelled ground - quantum of check shall be one per 1000 SQM
294	ii	Moisture content of fill before compaction	As per IS: 2720	Major	Physical	One in every 2000 cum for each type and source of fill materials	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification, IS 2720 (Pt.II)	SR		x	x	x	In cutting or existing levelled ground - quantum of check shall be one per 1000 SQM
295	iii	Dry density by core cutter method ---- OR---- Dry density in place by sand displacement method	As per IS: 2720	Critical	Physical	One in every 500 SQM area for each compacted layer.	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification, IS 2720 (Pt. XXIX)/ IS 2720 (Pt. XXVIII)	SR	√	x	x	x	Both for embankment and cut formation quantum of check - One in every 1000 SQM area for each compacted layer.
296	iv	Lines, grade and cross section	As required / agreed	Major	Physical	One in every 500 SQM area	As per Tech Specs and Const. Drawings	SR	√	x	x	x	Template, straight edge

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297	b	Water Bound Macadam (Non-Bituminous) for base course and sub-base course											
298	i	Aggregate Impact value	Aggragate Impact value Test Apparatus	Critical	Physical	One test per 200 cum of Test aggregate	As perTech Specs and Const. Drawings, Section 900 of MORTH specification	SR	√	x	x	x	
299	ii	Grading	Set of IS Sieves	Major	Physical	One test per 100 cum of aggregate	As perTech Specs and Const. Drawings, Section 900 of MORTH specification	SR		x	x	x	
300	iii	Flakiness index and elongation index	Flakiness test gauge	Major	Physical	One test per 200cum of agregate	As perTech Specs and Const. Drawings, Section 900 of MORTH specification	SR		x	x	x	
301	iv	Atterberg Limits of binding material	Atterberg limits determination	Critical	Physical	One test per 25 cum of binding material	As perTech Specs and Const. Drawings, Section 900 of MORTH specification	SR	√	x	x	x	
302	v	Atterberg Limits of portion of agreggate passing 425 micron sieve	Atterberg limits determination	Critical	Physical	One test per 100cum of aggregate	As perTech Specs and Const. Drawings, Section 900 of MORTH specification	SR	√	x	x	x	
303	vi	Camber, surface, slope	As required / agreed	Major	Physical	One in every 500 SQM area	As per Tech Specs and Const. Drawings	SR	√	x	x	x	Template, straight edge
304	c	Bituminous Macadam for base and binder course											
305	i	Quality of binder	Penetrometre with St. needle	Critical	Physical	No. of samples per Lot & tests as per IS:73, IS:217, IS:8887 as applicable	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification, IS 73	SR	√	x	x	x	
306	ii	Aggregate Impact Value / Los angeles abrasion value	Aggregate Impact ValueTest apparatus	Major	Physical	Once per source	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification	SR	√	x	x	x	
307	iii	Flakiness Index and elongation index of aggregates	Flakiness test gauge	Major	Physical	One test per 50 cum of aggregate	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification	SR		x	x	x	
308	iv	Stripping value of aggregate (Immersion tray test)	As required / agreed	Major	Physical	Initially one set of 3 representative specimen per source, and on every change of source.	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification	SR		x	x	x	
309	v	Water sensitivity of mix	As required / agreed	Critical	Physical	Initially one set of 3 representative specimen per source, and on every change of source.	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification	SR	√	x	x	x	
310	vi	Grading of aggregates	Set of Sieves	Major	Physical	Two test per day per plant both on individual constituents and mixed aggregate from dryer	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR		x	x	x	
311	vii	Water absorption of aggregate	As required / agreed	Major		Initially one set of 3 representative specimen per source, and on every change of source.	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR		x	x	x	

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312	viii	Soundness (Magnesium and Sodium Sulphate)	As required as per IS:2386	Critical	Physical	Once per source by each method and on every change of source	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR	√	x	x	x	
313	ix	Percentage of fractured faces	As required / agreed	Major	Physical	When gravel is used one test per 50cum of aggregates	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR		x	x	x	
314	x	Binder content and aggregate grading	Bitumen extractor	Critical	Physical	Periodic, subject to a min of two tests per day per plant	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification	SR	√	x	x	x	
315	xi	Control of Temperature of binder and aggregate for mixing and of the mix at the time of laying and rolling	Thermometer	Major	Physical	At regular close intervals	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification	SR		x	x	x	
316	xii	Rate of spread of mixed materials	As required / agreed	Major	Physical	Regular control through checks of layer thickness	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification	SR		x	x	x	
317	xii	Density of compacted Layer	As required / agreed	Critical	Physical	One test per 250 sqm of area	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification	SR	√	x	x	x	
318	c	Bituminous Surfacing - Open graded premix carpet and Seal coat											
319	i	Quality of binder	Penetrometre with St. needle	Critical	Physical	No. of samples per Lot & tests as per IS:73, IS:217, IS:8887 as applicable	IS 73,Tech Specs and Const. Drawings, Section 900 of MORTH specification	SR	√	x	x	x	
320	ii	Aggregate Impact Value / Los angeles abrasion value	Aggregate Impact ValueTest apparatus	Major	Physical	One test per 50 cum of aggregate	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification	SR	√	x	x	x	
321	iii	Flakiness Index and elongation indexof aggregates	Flakiness test gauge	Major	Physical	One test per 50 cum of aggregate	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification	SR		x	x	x	
322	iv	Stripping value of aggregate (Immersion tray test)	As required / agreed	Major	Physical	Initially one set of 3 representative specimen per source, and on every change of source.	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification	SR	√	x	x	x	
323	v	Water absorption test		Critical	Physical	Initially one set of 3 representative specimen per source, and on every change of source.	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification	SR	√	x	x	x	
324	vi	Water sensitivity of mix	As required / agreed	Critical	Physical	Initially one set of 3 representative specimen per source, and on every change of source.	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification	SR	√	x	x	x	
325	vii	Grading of aggregates	Set of Sieves	Major	Physical	One test per 25 cum of aggregates	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification	SR	√	x	x	x	

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326	viii	Soundness (Magnesium and Sodium Sulphate)	As required as per IS:2386	Critical	Physical	Once per source by each method and on every change of source	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification	SR	√	x	x	x	
327	ix	Polished stone value	As required as per BS:812(Part 114)	Major	Physical	As required	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification	SR		x	x	x	
328	x	Temperature of binder at application	Thermometer	Major	Physical	At regular close intervals	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification	SR		x	x	x	
329	xi	Binder content	Bitumen extractor	Critical	Physical	One test per 500 cum& not less than two tests per day	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification	SR	√	x	x	x	
330	xii	Rate of spread of materials	As required / agreed	Major	Physical	One test per 500 cum and not less than 2 tests per day	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification	SR		x	x	x	
331	xiii	Percentage of fractured faces	Bitumen extractor	Critical	Physical	When gravel is used one test per 50cum of aggregates	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification	SR	√	x	x	x	
332	d	Tack Coat/ Prime coat/ fog coat											
333	i	Quality of binder	Penetrometre with Standard needle	Critical	Physical	No. of samples per Lot & tests as per IS:73, IS:217, IS:8887 as applicable	IS 73,Tech Specs and Const. Drawings, Section 900 of MORTH specification	SR	√	x	x	x	
334	ii	Temperature of binder at application	Thermometer	Major	Physical	At regular close intervals	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification	SR		x	x	x	
335	iii	Rate of spread of binder	As required / agreed	Major	Physical	One test per 500 cum and not less than 2 tests per day	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification	SR		x	x	x	
336	e	Alignment, Level, Surface regularity and rectification											
337	i	Horizontal alignment, Surface levels and Surface regularity	As required / agreed	Major	Physical	At Random	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification	SR	√	x	x	x	
338	ii	Rectification	As required / agreed	Major	Physical	Each rectification	As per Tech Specs and Const. Drawings, Section 900 of MORTH specification	SR		x	x	x	
340	28	Geotechnical Investigations											
341	i	Deployment of approved Geotechnical Investigation Agency - Equipments, Manpower etc	As required / agreed	Critical	Physical	Once before commencement of work	As per technical specifications and relevant IS Codes	SR	√	x	x	x	
342	ii	Execution of Geotechnical Investigation - locations, type etc as per scheme	As required / agreed	Major	Physical	Each Location	As per technical specifications and relevant IS Codes	SR		x	x	x	
343	iii	Collection of disturbed and undisturbed samples , their packing and storage	As required / agreed	Major	Physical	each sampling	As per technical specifications and relevant IS Codes	SR		x	x	x	
344	iv	Conducting filed tests as per investigation scheme- such as, SPT/ERT/SCPT/PLT/PMT etc	As required / agreed	Major	Physical	each field test	As per technical specifications and relevant IS Codes	SR		x	x	x	


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345	v	Submission of Field Borelogs in approved format	As required / agreed	Major	Review	Within 24 hours after completion of each BH	As per technical specifications and relevant IS Codes	SR		x	x	x	
346	vi	Submission of laboratory test schedule and selection of samples for laboratory testing	As required / agreed	Critical	Review and acceptance	as per consultation with engineer during dispatch of samples to approved laboratory	As per technical specifications and relevant IS Codes	SR	√	x	x	x	
347	vii	Submission of Final Geotechnical investigation report along with recommendations	As required / agreed	Critical	Physical	After completion of investigation work and review of draft reports	As per technical specifications and relevant IS Codes	SR		x	x	x	
349	29	Topographical Survey Works											
350	i	Deployment of approved Topographical Surveying Agency - Equipments, Manpower etc	As required / agreed	Critical	Physical	Once before commencement of work	As per technical specifications and relevant IS Codes	SR	√	x	x	x	
351	ii	Transfer of Permanent Bench mark to site from known location	As required / agreed	Major	Physical	Before commencement of work	As per technical specifications and relevant IS Codes	SR		x	x	x	
352	iii	Establishment of boundary pillars and survey grid, Temporary bench Marks, Measurement & recording spot levels	As required / agreed	Major	Physical		As per technical specifications and relevant IS Codes	SR		x	x	x	
353	iv	Recording features like trees, roads, transmission lines, lake, nala, river, temple, house, culverts etc. with coordinate locations	As required / agreed	Major	Physical		As per technical specifications and relevant IS Codes	SR		x	x	x	
354	vi	Submission of final Counter map showing all topographical features, record of spot levels	As required / agreed	Critical	Physical	After completion of investigation work and review of draft reports	As per technical specifications and relevant IS Codes	SR	√	x	x	x	
356	30	Internal Switchyard - Site Leveling & Grading											
357	i	Leveling Switchyard area	As required / agreed	Major	Visual / Physical	100%	As perTech. Specification and Approved Drawing	SR		x	x	x	
358	ii	Grading of 20/40mm stone / Gravel Spreading in sitchyard area	As required / agreed	Major	Physical	100%	As per Tech. Specification & Approved Drawing	SR		x	x	x	
360	31	Plant Boundary Fencing (if applicable) & Gate (Also refer S.No. 3 for Steel works as applicable)											
361	i	Fence posts (Intermediate, Stay & Corner Posts etc.) - Section size, Length, Galvanization - Grade/ Thickness, Tensile strength etc.	As agreed/ Required	Critical	Physical/ Measurement/ Review of MTC	Each lot received at site Random	IS:226; IS:2721; IS:278; IS:480; IS:4826 , Tech. Specs & Construction Drawings	MTC/ SR	√	x	x	x	For Structural steel checks refer S.No. 3
362	ii	Barbed wire - Dia. of line wire and barb wire, Grade of galvanization etc, Tensile strength etc.	As agreed/ Required	Critical	Physical/ Measurement/ Review of MTC				√	x	x	x	
363	iii	Tie wire - Diameter, Galvanization-Grade, tensile strength etc.	As agreed/ Required	Critical	Physical/ Measurement/				√	x	x	x	
364	iv	Blade barbed/ Concertina Wire - Thickness/ Diameter, galvanization, Diameter of concertina coil, Tensile strength etc.	As agreed/ Required	Critical	Physical/ Measurement/ Review of MTC				√	x	x	x	

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365	v	Fence Fabric- Mesh size, Wire Diameter, Galvanization-Grade, Selvage, Knuckling, Tensile strength etc.	As agreed/ Required	Critical	Physical/ Measurement/ Review of MTC				√	x	x	x		
366	vi	MS Gate - Caster weels, ball & bearings, Fixtures & fasteners etc.	As agreed/ Required	Major	Visual	100%	Tech. Specs & Construction Drawings	SR		x	x	x		
367	vi	Acceptance of Boundary Fence and gate	As agreed/ Required	Major	Physical	100%	Tech. Specs & Construction Drawings	SR		x	x	x		
369	32	Tranformer Yard Fencing & Gate (Also refer S.No. 3 for Steel Works as applicable)												
370	i	Fence posts (Intermediate, Stay & Corner Posts), Concertina Wire Support Angles - Section size, Length, Galvanization, Tensile strength etc.	As agreed/ Required	Critical	Physical/ Measurement/ Review of MTC	Each lot received at site Random	IS-226; IS 2721; IS-4948 , IS:480; IS:4826 Tech. Specification and Approved Drawing	MTC/ SR	√	x	x	x	For structural steel checks refer S.No. 3	
371	ii	Tie wire (as aplicable) - Diameter, Galvanization, Tensile strength etc.	As agreed/ Required	Critical	Physical/ Measurement/ Review of MTC				√	x	x	x		
372	iii	Fence Fabric (chain link/ welded wire as aplicable)- Mesh size, Wire Diameter, Galvanization, Selvage, Knuckling, Tensile strength etc.	As agreed/ Required	Critical	Physical/ Measurement/ Review of MTC				√	x	x	x		
373	iv	MS Gate - Fixtures and fasteners	As agreed/ Required	Major	Visual	100%	Tech Specs andApproved Drawings	SR		x	x	x		
374	v	Acceptance of Fence & Gate	As agreed/ Required	Major	Physical	100%	Tech Specs and Approved Drawings	SR		x	x	x		
376	33	Installation of Pre Engineered Building (PEB) - Security Cabin												
377	a	Receipt												
378	i	Receipt of materials and Checking as per packing list	As agreed/ Required	Major	Visual	100%	As per Approved Drawings & Method Statement, Relevant BIS standards	SR	√	x	x	x		
379	iii	Dimensional Check	As agreed/ Required	Major	Measurement	100%			√	x	x	x		
380	iv	Visual checks for damages, rusting, pitting etc.	As agreed/ Required	Major	Visual	100%				x	x	x		
381	v	Visual checks for defects, primer coating and painting/galvanising as applicable.	As agreed/ Required	Major	Visual	100%				x	x	x		
382	vi	Nut/Bolt/Washers Checks	As agreed/ Required	Major	Visual	100%				x	x	x		
383	b	Pre-Installation												
384	i	Check that the work area is ready and safe to start installation	As agreed/ Required	Major	Visual / Dimension					x	x	x		
385	ii	Check readiness of Foundations	As agreed/ Required	Major		100%				x	x	x		
386	c	Installation (as aplicable)												
387	i	Readyness of concrete platform, foundations for installation- Size, Location, Level etc.	As agreed/ Required	Major	Visual					x	x	x		
388	ii	Check PUF side walls/ roof are installed properly	As agreed/ Required	Major	Physical					x	x	x		
389	iii	Check tightening of all Nut/Washers/Bolts	As agreed/ Required	Major	Physical					x	x	x		
391	34	Structural Work for Module Mounting Structure (MMS)					Tech. Specification, Approved Drawing & Method Statement							
437	a	Manufacturing												

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438		Strucural Steel (Raw Material) Hot rolled & cold formed sections - Angle, Channel, Z-section, Box section, Plate, rod & bar											
439	i	Ultimate Tensile Strength (UTS), Yield Strength (YS), Percentage Elongation, Bend Test, Chemical Composition, Section dimensions	As agreed/ Required	Critical	Chemical composition, Mechanical, Measurement	1 Sample per 50 MT or part thereof/ for every heat no.	IS 2062, IS 513, IS 811, IS 1079, IS 808, IS 1852, IS 1730 -Part I	MTC	√				Raw material to be procured from reputed manufacturers - like SAIL, RINL, JSPL, JSW, TISCO, ISSAR
440	ii	Visual Examination - Cracks, Scaling, Rust, Pitting, Lamination etc.	As agreed/ Required	Major	Visual	10% IS 2500, Level II, AQL 1.5	IS 2062, IS 513, IS 811, IS 1079, IS 808, IS 1852, IS 1730-Part I	SR	√	x	x	x	Material shall be free from surface defects like cracks, lamination, roughness, imperfect edges, rust, pitting & other harmful defects. Removal of minor surface defects as per IS:2062 is acceptable. Witness for 10% sample. Record review for every material
441		Boughtout Items (Hardware - Nuts, Bolts and Washers - plain, spring)											
442	i	Mechanical & Chemical Properties	As agreed/ Required	Critical	Chemical composition, Mechanical	1 sample per 5 MT or part thereof	IS 1327 (Part 17) eq./ ASTM standard	MTC/ Lab test Report	√	x	x	x	
443	ii	Dimensional check (Dia., Thickness, Total stem length & Threaded length etc.)	As agreed/ Required	Major	Measurement	IS 1327 (part 17) eq 10 pieces per lot per member type	IS 6639, IS 2016, IS 6610 & IS 3063 / ASTM standard	Vendor Records	√	x	x	x	Witness for sample. Record review for every material
444	iii	Galvanizing - Mass per Sqm, Thickness (DFT)	As agreed/ Required Alcometer	Major	Visual, Measurement	IS 1327 (part 17) eq 10 pieces per lot per member type	For Hot dip galvanizing should be maintained 43 microns (min) and average 54 microns as per IS 1367 (part XIII) eq.	Vendor Records	√	x	x	x	Record review Random sample inspection/ measurement
445	b	In Process Inspection											
446		Structural Item Fabrication											
447	i	Straightening	As agreed/ Required	Major	Visual	100%	0.2% of total length	Vendor Records	√	x	x	x	Record review
448	ii	Cropping (Cutting)	As agreed/ Required	Major	Visual	100%	Approved drawing	Vendor Records	√	x	x	x	Record review
449	iii	Identification/ Marking	As agreed/ Required	Major	Visual	100%	Approved drawing Marking Shall be done with the help of permanent paint marker using stencil as per Drawing	Vendor Records	√	x	x	x	Record review Random sample inspection
450	iv	Punching/ Drilling of Holes	As agreed/ Required	Critical	Measurement	1 piece per 25 pieces	IS 802/ Approved drawing	Vendor Records	√	x	x	x	Record review
451		Edge Security							√	x	x	x	
452	v	Overall Length	As agreed/ Required	Major	Measurement	1 piece per 25 pieces	IS 802/ Approved drawing	Vendor Records	√	x	x	x	Record review Random sample measuremnt
453	vi	Bending	As agreed/ Required	Critical	Measurement	100%	IS 801, 811/ Approved drawing	Vendor Records	√	x	x	x	
454		Cross Section Dimensions							√	x	x	x	Record review
455	vii	Welding	As agreed/ Required	Major	Visual	100%	Approved Welding Procedure & Welder Qualification	Vendor Records	√	x	x	x	Record review Random sample ispection
456	viii	Visual Examination - Black spots, Porosity, Spatter, Rust bleed points, Weld dimensions	As agreed/ Required	major	Visual	100%	Tech. Specification, Approved Drawing	Vendor Records	√	x	x	x	Record review Raddom sample inspection (The fabricated material shall be free from
457	ix	DP Test (as necessary)	As agreed/ Required	Major	Chemical	Shift wise/ random	As and when required	Vendor Records	√	x	x	x	
458	x	Final Inspection of Fabricated Parts - Cross section dimensions, Thickness (before galvanization)	As agreed/ Required	Critical		10 % in lot size of 100 nos.	IS- 802, IS 807, IS 811 and relevant applicable eq. standards , approved drawings, Tech spec	Vendor Records	√	x	x	x	
459		Galvanizing											
460	i	Zinc - Ingot, Molten metal in galvanizing bath	As agreed/ Required	Critical	Chemical	1 sample from each batch of ingot supply	IS 2629	MTC Lab test report	√	x	x	x	Purity of Zn 98.5%, MTC to be correlated. Molten metal in the galvanizing bath ≥ 98.5 % by mass of zinc.
461		Pre Galvanizing											

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462	i	Degreasing	Acid base cold degreaser	Major	Chemical	One sample daily	Sp. Gravity 1.1 to 1.2, ph Value 2 to 3	Vendor Records	√	x	x	x	Record review
463	ii	Pickling - Acid & Iron content	Lab test	Major	Chemical	One sample daily	Acid Content-Concentration 18% to 4% min, Sp. Gravity 1 to 1.3 Iron Content -120g/litre (max)	Vendor Records	√	x	x	x	Record review
464	iii	Rinsing	pH meter	Major	Chemical	One sample daily	Rinsing water ph value 5 to 7	Vendor Records	√	x	x	x	Record review
465	iv	Pre-fluxing in ZnCl solution - Specific gravity, pH	pH meter	Major	Measurement	One sample daily	Sp Gr - 1.10 to 1.26 pH - 3 to 5	Vendor Records	√	x	x	x	Record review
466	v	Pre-heating	Pyrometer	Major	Measurement	One sample daily	Above 50° C	Vendor Records	√	x	x	x	Record review
467	vi	Dipping - Zinc bath temperature, Imersion & withdrawl time	Continuous recording & verification by Pyrometer	Major	Measurement	Hourly check	Zn bath temp - 440° C to 460° C Article to be immersed till reaction	Vendor Records	√	x	x	x	Record review
468	vii	Quenching	Plain water	Minor			Bath in plain water for cooling & Cleaning. Temp. Below 65°	Vendor Records	√	x	x	x	Record review
469	viii	Di-chromating	Di-chromate solution	Major	Chemical	One sample daily	strength of the solution to be maintained as 0.7 to 1% of sodium dichromate, temperature of solution should be less than 65°	Vendor Records	√	x	x	x	Record review
470		Post Galvanizing											
471	i	Surface Defects/Finish - Dross, Pimples, Black marks, Ash deposition	As agreed/ Required	Major	Visual	100%	IS 2633	Vendor Records	√	x	x	x	Record review Random samples to be inspected during
472	ii	Thickness of Zinc Coating	Alcometer	Critical	Measurement	3 samples per dip	As Per IS 4759 , 6745 , Minimum 80micron or as per spec.	Vendor Records	√	x	x	x	Record review Random samples to be measured during factory visit by Owner/PMC
473	iii	Mass of Zinc Coating		Critical	Chemical	1 sample per shift	As Per IS 6745	Vendor Records	√	x	x	x	Record review
474	iv	Uniformity of Zinc Coating (Preece Test)		Major	Chemical	1 sample per shift	No red stains after 4 dippings	Vendor Records	√	x	x	x	Record review/ Sample test if deemed necessary
475	v	Adhesion of Zinc Coating (Pivote Hammer Test/ Knife Test)		Major	Physical	1 sample per hour	No Removal or lifting in areas between hammer impression/coating should not peel off. As per IS 2629	Vendor Records	√	x	x	x	Record review Random samples to be inspected during factory visit by Owner/PMC. Sample test if deemed necessary
476		Proto Assembly											
477	i	Proto Assembly check - Fitment, Dimensions, Alignment, Overall Stability	Prototype of one mounting table with	Critical	Physical/ Measuremnt	100%	Cut lengths of all members, Fitment (dia. of holes, end security, c/c distance between holes etc. shall be checked for correctness wrt permissible tolerance through in postion inspection of assembled proto), Fasteners (bolts, nuts and washers), Cleats, Gussete plates shall be as per Approved drawing/ specifications. The proto assembly shall be checked for overall stability for design verification of various conenctions and col. support system.	IR	√	x	x	x	The general quality of fabrication and galvanization of members, straightness of members, overall stability of prototype etc. shall be checked for design verification. Any suggestions for design changes etc. shall be properly recorded in the inspection report for implimentation in mass production of MMS members
478		Marking/ Packaging											
479	i	Marking	As agreed/ Required	Major	Visual	100%	Approved drawing/ marking scheme	IR	√	x	x	x	Record review Random sample shall be checked during facroty visit by Vendor and SECI/ Owner representative

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480	ii	Packaging, Storing, Bundling, Handling	As agreed/ Required	Major	Visual	100%	As per IS-802. Packing of Column. Bracing, Rafters and Purlins shall be done by strapping. Packing of smaller items by wires or in gunny bags/ or as per approved procedure	IR	√	x	x	x	Separate packaging for different type of members like Col, Purlin, Rafter, Front/ rear/ diagonal bracings, fasteners, cleats etc. Small members shall be bundled with wire. Damage to galvanization and form (shape) of the member during handling and trasporting shall be controlled
481		Site Installation								x	x	x	
482	i	Receipt of materials and Checking as per packing list	As agreed/ Required	Critical	Visual	Random	Tech. Specification, Approved Drawing & Method Statement.		√	x	x	x	
483	ii	Fabricated members - Dimensional Check	As agreed/ Required	Major	Visual	100%				x	x	x	
484	iii	Visual checks for defects/damages, rusting, pitting, galvanising etc.	As agreed/ Required	Major	Visual	Random				x	x	x	
485	iv	Nut/Bolt/Washers	As agreed/ Required	Major	Measurement	100%				x	x	x	
486	v	Mounting of structures & Accessories - Coordinates, Levels, Fitment, Alignment etc.	As agreed/ Required	Critical	Visual /Measurement	100%			√	x	x	x	
487	vi	Torque Checking - Daily calibration check, Bolt installation	As agreed/ Required	Major	Measurement	100%				x	x	x	
489	35	Module Mouting - Pre Installation Check			Visual	100%							
490	i	Check for site physical layout as per drawing / Design Specification		Major	Physical	100%				x	x	x	
491	ii	Check for Structure, Mounting readiness		Major	Physical					x	x	x	
493	36	String Combiner Boxes (SCB) - Mouting - Pre Installation Check											
494	i	Check for foundation readiness - location & coordinates, dimensions & levels, foundation bolts etc.		Major	Physical	100%				x	x	x	
496	37	Inverter Panel					Design Specification, Drawings, Manufacturer Manual Method Statement	SR					
497		Pre Installation											
498	i	Check for site physical layout as per drawing.		Major	Visual	100%			√	x	x	x	
499	ii	Ensure that no fouling with civil/structural		Major	Physical	Random				x	x	x	
500	iii	Check for Foundation readiness and level of foundation.		Major	Physical	100%				x	x	x	
502	38	Burried Cables					Design Specification, Drawings, Manufacturer Catalogue Method Statement (SW-SEPC-MS-CAB-006)						
503	i	Cable Trench - Dimensions, alignment		Critical	Physical	100%	Design Specification, Drawings, Manufacturer Catalogue Method Statement	SR		x	x	x	
504	ii	Sand filling before cable laying, sand filling after cable laying, placing of precast concrete slabs/ bricks, backfilling with soil		Major	Visual	100%				x	x	x	
586													
587													
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589													
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2													
592			LEGEND: D * Records, indentified with "Tick" (√) shall be essentially included by supplier in QA documentation.							DOC. NO.: SECI - XXX - XXX -XXX - FQP & MQP - 001 REV: 0			
593			Legend to be used:										
594			Class # : A = Critical, B=Major, C=Minor										
595			Format of Record # : SR=Site Register, TR=Lab Test Report, IR=Inspection Report, MTC=Manufacturer's Test Certificate										
596			All MTC's shall be correlated with batch of material supply, Tech specs and drawings										
597			Category 'A' - Sub-contractor/ sub-vendor, EPC Vendor, SECI/ Owner										
598			Category 'B' - Sub-Contractor/ Sub-Vendor, EPC Vendor, SECI										
599			Category 'C' - Sub-Contractor/ Sub-Vendor										
600									Reviewed By	Approved By	Approval Seal		
601			This document shall be read in conjunction with Tech. Specifications and Drawings										



Tender for Design, Engineering, Supply, Construction, Erection, Testing, Commissioning and O&M of 5 MW Grid Connected Solar PV Power Plant at VOCPT, Tuticorin



Annexure – C

PG Test Procedure

**5 MW (AC) Grid Connected
Solar PV Plant at VOCPT,
Tuticorin**

**Tender No.
SECI/C&P/NIT/2021/VOCPT5**

**ANNEXURE-C
Page 1 of 10**

**Signature of
Bidder**



Tender for Design, Engineering, Supply, Construction, Erection, Testing, Commissioning and O&M of 5 MW Grid Connected Solar PV Power Plant at VOCPT, Tuticorin



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1 INTRODUCTION

This document lays down the procedures and requirements for conducting Functional Guarantee tests including scope of the tests, procedures for the tests, reporting formats and process for determining test results in accordance with the Tender Specifications, applicable standards and industry best practices.

2 FUNCTIONAL GUARANTEE TESTS FOR SOLAR PV PLANT

Functional Guarantee for Solar PV Plant shall comprise of following Guarantees:

- (1) Performance Ratio Guarantee test for operational acceptance.

2.1 PERFORMANCE RATIO GUARANTEE TEST

A Performance Ratio Guarantee test shall be commenced within 60 days of the commissioning of Plant Facilities to demonstrate that the plant has achieved the Guaranteed Performance Ratio in line with requirements under section VII of the bidding document. This will be one of the pre-conditions for the Plant Operational Acceptance. Performance Ratio (PR) test period would be continuous measurement of 30 consecutive days. The test shall be conducted in accordance with the IEC-61724 as per the methodology described in Technical Specifications under section VII of the bidding document. The procedure of PR test is described further in Section 2.1.4. The report shall contain all the measured energy and Met data values, calculations, results and conclusions.

2.1.1 Performance Ratio

The Performance Ratio (PR) of the PV Plant is calculated as follows (according to IEC 61724).

$$PR = \frac{E_{out}}{\sum_k \left(\frac{(C_k \times P_o) \times (G_{i,k} \times \tau_k)}{G_{i,ref}} \right)}$$

where

PR Temperature Corrected Performance Ratio

E_{out} Cumulative AC energy measured at the Plant End (ABT meter) over the duration of reporting period (kWh)

τ_k Duration of the k^{th} recording interval, i.e. (1/60) hour

\sum_k Summation over all recording intervals in the reporting period, (1/4) hour

C_k Power rating temperature adjustment factor and can be calculated as below

$$C_k = 1 + \gamma \times (T_{avg_mod,k} - T_{ref})$$

γ Temperature coefficient of power with negative sign ($^{\circ}C^{-1}$)

$T_{avg_mod,k}$ Average PV Module temperature measured at the commencement of time interval ' τ_k ' ($^{\circ}C$)



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T_{ref}	PV Module temperature at which P_o is determined, i.e. 25°C
P_o	Installed nominal peak power of PV modules, i.e. Nameplate rating at STC (kW_p)
$G_{i,k}$	Average irradiance measured at the Plane of Array (POA) at the commencement of time interval τ_k (kW/m^2) (average of all Pyranometres in various sites)
$G_{i,ref}$	Irradiance value at which P_o is determined, i.e. 1 kW/m^2

2.1.2 General Requirement

- The Functional Guarantee shall comprise of a set of visual/mechanical/Electrical checks followed by a Performance Ratio (PR) test of the Plant Facilities.
 - The PR test shall be carried out for a period of 30 days at site by the Contractor in presence of the Employer/ Employer's Representative/ Owner's Engineer.
 - These tests shall be binding on both the parties to the contract to determine compliance of the equipment with the guaranteed performance parameters.
 - The test will consist of guaranteeing the correct operation of the Plant Facilities, by way of the performance ratio based on the reading of the energy produced and delivered to the grid (ABT meter) and the Plane of Array incident solar radiation.
 - PR is calculated as per the formula given in Clause no. 2.1 and recorded as per the format provided at **Annexure 1**.
 - The filled-in format shall be signed by both the parties (EPC Contractor and SECI) and each party will keep one copy for record. **The same will be recorded for 30 days.**
 - The Functional Guarantee condition for the purpose of Provisional Acceptance of the Plant Facilities shall be considered to have been met if the average of daily PRs (for 30 days*) is greater than or equal to the guaranteed Performance Ratio (PR).
 - During this PR test, equipment failure/interruption of any kind, except for SCADA communication failures, will not be accountable. In case of a breakdown, the test may be resumed once the complete system is rectified and working properly.
- * 30 days excluding any interruption due to rainy/cloudy day or allowable Interruptions as per this document. Interruptions due to communication breakdown only may be exempted based on specific approval to the effect that generation is not affected and equipment failure (Refer Clause 2.1.5) is not attributable. In such case, the test shall be extended for affected no. of days (up to 5 days)



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2.1.3 Pre-PR Test

2.1.3.1 The EPC Contractor shall perform start-up tests after completion of Commissioning and Test Procedure as per Annexure – D: Plant Documentation, Commissioning and Test Procedure and recording of punch points.

2.1.3.2 Functional Guarantee Test shall commence immediately after all issues arising from the functional/ start-up test have been rectified.

Note:

- (a) All measurement(s) procedure should be carried out taking proper safety precaution.
- (b) Also it should be ensured that to avoid any loose connection at the terminal points for which measurement procedure is conducted.
- (c) Ensure proper functioning (e.g. Multimeters shall be calibrated) of all measuring instruments before conducting above measurement procedure.
- (d) The above test procedure shall be conducted in presence of site in-charge.

2.1.4 PR Test Procedure

The date of commencement of the PR Test shall be communicated in advance and agreed upon by both parties i.e. SECI and EPC Contractor. Any consecutive 30 days period (excluding interruptions that last entire day on account of grid outage or as per hindrance record maintained at site or weather conditions) for the purpose of conducting PR test shall be mutually discussed and agreed between SECI and EPC Contractor. It shall comprise of the following procedures.

2.1.4.1 Pre-test Procedure

- (1) Before the commencement of Performance Ratio (PR) test, the plant shall have completed Pre-PR tests as per Clause 2.1.3 above and SCADA system and WMS shall be fully commissioned and functional.
- (2) Trial Run: The PG Test for Plant Facilities shall commence with a trial run for 7 consecutive days. The EPC Contractor shall provide the data in requisite formats (specified elsewhere in the document) to SECI. SECI shall vet the data for any discrepancies and systemic errors and revert within 3 working days. Post the trial run period, the 30 days PR test will commence after communication from SECI in this regard.
- (3) Pyranometer Tilt Angle & Cleanliness: The pyranometers & Tilt Angle shall be verified before the test commences and **then visually inspected at regular intervals for cleanliness during the tests.**
- (4) The average POA radiation of all the Pyranometers ($G_{i,k}$) shall be considered for the calculation of PR. The average of module temperatures recorded by all the temperature



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sensors shall be used for calculation of PR. The Pyranometers and Temperature sensors used for the purpose of the PR Test shall have valid calibration certificates.

2.1.4.2 Following the completion of the pre-test procedures, Performance Ratio Test of plant shall commence in accordance with the procedures, conditions and requirements provided in the next section.

2.1.4.3 General Procedure for the PR Test

The PR Test Procedure shall include the following components:

(1) **Data Collection:** PV Power Plant test related parameters are collected in one-minute and 15 intervals for the 30 (Thirty) days reference period. The data shall consist of the following at a minimum:

- Irradiance at Collector's (i.e. PV Module) POA; (Source: SCADA, Temporal Resolution: 1 minute) Average values from all the sites will be considered
- Other Met Data received from installed WMS; (Source: SCADA, Temporal Resolution: 1 minute)
- Energy generated at Plant (kWh) (Source: Plant TVM Meter from SCADA, Temporal Resolution: 1 minute)
- Energy injected into grid (kWh) (Source: Plant End ABT Meter, Temporal Resolution: 15 minute)
- PV Module Temperature recorded from the temperature Sensors (°C) (Source: SCADA, Temporal Resolution: 1 minute)

(2) **Data Filtering:** The data shall be filtered so that the data set is free of nuisance data points and bad data that exhibit a high degree of error (such as errors caused by faulty instrumentation). The EPC Contractor shall document data which is to be eliminated along with reasons. The following criteria shall be excluded from the dataset used for this test:

- **Nuisance or bad data** – Nuisance data points or bad data that clearly exhibit a high degree of error (eg. due to rainy/cloudy weather or meteorological measurement equipment that is identified as being out of calibration or requiring adjustment). A 15-minute time-block shall be *explicitly* flagged through a flag parameter on account of this factor after recording reasons thereof (**Note:** no filtration shall be done at site level). The same shall be corroborated/verified by SECI. Suitable statistical methods may be applied to identify such erroneous data.
- Time blocks with insufficient (less than equal to 10) 1-minute records.
- **Grid Interruptions** – Time periods (in 15-minute time blocks) of the grid interruptions at the utility substation, recorded manually jointly by EPC Contractor and SECI

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representatives shall be eliminated. Grid outage period, if any, shall be verified from SCADA.

- Any Force majeure conditions
- **Radiation Criteria** – Radiation on Plane of Array (POA) less than 200 W/m²
- Shutdown explicitly demanded by the Owner/DISCOM/STU.
- As per the hindrance record maintained at site.

Note: Minimum 24 Nos of 15-minute time blocks shall be considered to account the day for PR measurement. Otherwise the PR test shall be extended to another day.

2.1.5 Determination of PR Test

Daily PR shall be calculated as the average of the PR calculated for valid 15-minute time blocks (Refer Clause 2.1.4.3) for the 30-day duration. If the ABT Meter data is not available on daily basis, PR shall be calculated based on the MFM data and shared for record. However, at the end of the PR test period, the daily PR shall be re-calculated with the ABT Meter data for sign-off.

If the EPC Contractor is not able to demonstrate guaranteed PR during this period, two more chances shall be given to demonstrate the same after incorporation of suitable corrective measures. In case the contractor fails to achieve guaranteed PR even after the two more chances, further action shall be taken as per the provisions of contract.

The test shall be repeated for 30 days in case of any outage of following equipment (as applicable) for more than 7 days.

- Power Transformer/Inverter Duty Transformer
- Power Conditioning Unit
- HT Switchgear Panel
- SCADA and data logger combined
- Tilted pyranometer
- Other WMS sensors.

2.1.6 Raw Data Formats and Reports

The EPC Contractor shall submit to SECI the raw data from the Plant SCADA on daily basis in the following format.

Temporal Resolution: 1 Minute

Date & Time	Wind	Module	Ambient	Horizontal	POA	POA	Humidity	Wind	Generation
dd/mm/yyyy	Speed	Temp.	Temp.	Irradiance	Irradiance	Radiation	(%)	Direction	(kWh)
hh:mm:ss	(m/s)	(°C)	(°C)	(W/m ²)	(W/m ²)	(kWh/m ²)		(°)	(Source:
format									TVM)

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Temporal Resolution: 15 Minute (Every 15th Min record from the 1 Min Data)

Date & Time Dd/mm/yyyy hh:mm:ss format	Wind Speed (m/s)	Module Temp. (° C)	Ambient Temp. (° C)	Horizontal Irradiance (W/m ²)	POA Irradiance (W/m ²)	POA Radiation (kWh/m ²)	Humidity (%)	Wind Direction (°)	Generation (kWh) (Source: TVM)	Explicit Removal Flag* (0 or 1)	Remarks
---	------------------------	--------------------------	---------------------------	---	--	---	-----------------	--------------------------	---	--	---------

* Explicit Removal Flag: 0 indicates time block considered; 1 indicates time block not considered.

PR Test Report shall be generated from the Raw Data (Sample Report provided in the Annexure) after data filtering as per criteria laid out in (2). The Report shall contain the signature of both representatives (SECI/Employer & EPC Contractor).

Note: In case of multiple pyranometers/temperature sensors, the radiation and temperature data for the purpose of calculation of PR shall be derived from the average values from tilted pyranometer /temperature sensors.

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Reports

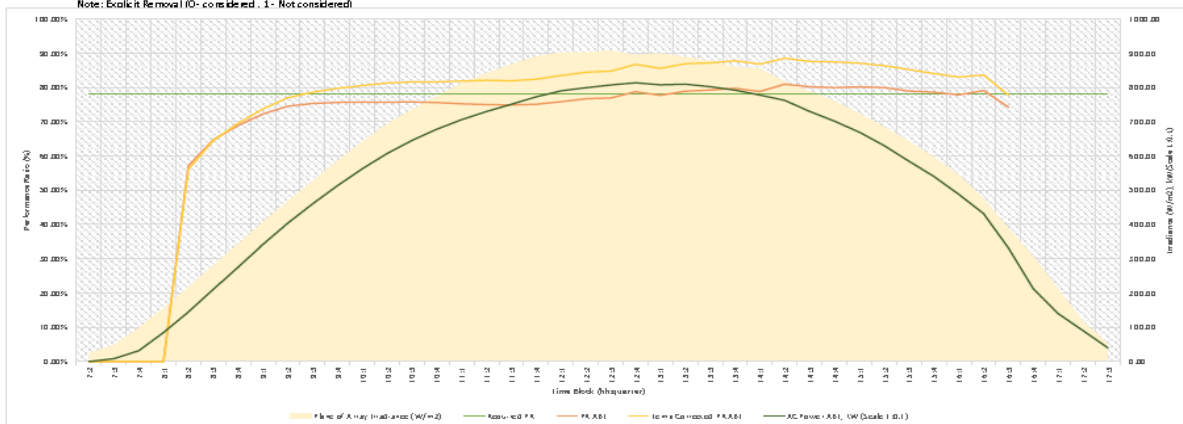
Sample Report for PR Test

PR Guarantee Test Report

Day	20-Nov-2016	Criteria	>200	Average POA Irradiance in a time block in W/m ²
No. of Timeblocks considered	36 /42	Tot Gen	53694 kWh	Source: ABT Meter at GSS
Plant PR for the day ABT	80.66%	Average PR (temp corrected) of 15 min time blocks where POA irradiance is greater than 200W/m ² and not explicitly removed (Guaranteed PR: 78%)		

Time Block (hh:Qtr)	Wind Speed (m/s)	Module Temp. (°C)	Ambient Temp. (°C)	POA Radiation (kWh/m ²)	Plane of Array Irradiance (W/m ²)	GHI (W/m ²)	Humidity (%)	Wind Direction (°)	Generation ABT GSS (kWh)	AC Power ABT, kW (Scale 1:0.1)	PR ABT	Temp Corrected PR ABT	Explicit Removal
7:2	1.62	13.91	15.10	2.17	25.25	27.00	45.92	88.10	0.00	0.00	0.00%	0.00%	0
7:3	1.41	14.47	15.25	12.34	47.92	50.47	45.53	38.35	21.00	8.40	14.73%	14.10%	0
7:4	0.57	15.84	15.73	25.08	98.48	92.93	44.41	0.00	79.00	31.60	27.27%	26.24%	0
8:1	0.26	17.73	16.01	39.51	156.11	143.67	44.55	0.00	212.00	84.80	46.45%	45.07%	0
8:2	0.66	20.64	17.01	54.73	216.78	193.67	42.19	0.00	361.00	144.40	57.10%	56.08%	0
8:3	0.43	24.09	17.94	70.40	279.62	245.80	40.17	0.00	526.00	210.40	64.69%	64.45%	0
8:4	0.71	27.22	18.85	86.46	343.62	291.80	38.39	0.00	688.00	275.20	68.90%	69.52%	0
9:1	0.71	29.93	19.74	102.34	407.36	348.47	36.74	0.00	854.00	341.60	72.25%	73.71%	0
9:2	0.71	32.98	20.73	117.25	466.99	398.00	35.17	0.00	1009.00	403.60	74.51%	76.95%	0
9:3	0.80	35.60	21.52	132.29	527.14	445.27	33.94	0.00	1151.00	460.40	75.33%	78.61%	0
9:4	0.74	38.17	22.31	146.86	585.56	486.27	32.98	0.00	1283.00	513.20	75.64%	79.72%	0
10:1	0.87	40.55	23.23	160.77	641.34	516.87	31.86	0.00	1406.00	562.40	75.72%	80.54%	0
10:2	0.93	42.99	24.08	173.62	692.91	540.33	31.13	0.00	1518.00	607.20	75.70%	81.28%	0
10:3	0.99	43.78	24.78	184.38	736.02	559.67	30.67	0.00	1613.00	645.20	75.74%	81.57%	0
10:4	1.38	44.44	25.53	194.12	775.43	576.53	29.87	12.76	1695.00	676.00	75.60%	81.63%	0
11:1	1.05	46.52	26.17	203.12	811.43	593.60	28.97	0.00	1765.00	706.00	75.23%	81.87%	0
11:2	0.89	48.11	26.74	210.57	841.02	609.07	28.28	0.00	1824.00	729.60	75.00%	82.10%	0
11:3	1.51	47.95	27.61	217.05	867.66	624.60	26.97	0.00	1877.00	750.80	74.87%	81.92%	0
11:4	2.03	48.74	28.04	222.77	890.54	642.47	25.69	76.95	1932.00	772.80	75.09%	82.40%	0
12:1	1.61	49.61	28.91	225.54	902.04	656.13	24.24	0.00	1975.00	790.00	75.82%	83.47%	0
12:2	2.03	49.58	29.45	225.55	902.30	664.40	22.97	129.40	1998.00	799.20	76.69%	84.42%	0
12:3	2.34	49.79	29.73	227.09	907.75	672.60	21.62	131.02	2018.00	807.20	76.94%	84.75%	0
12:4	2.48	49.66	29.92	223.65	895.29	671.87	20.71	96.20	2034.00	813.60	76.74%	86.70%	0
13:1	2.10	49.70	30.20	224.96	899.51	670.93	18.75	0.00	2019.00	807.60	77.71%	85.57%	0
13:2	2.32	49.80	30.31	222.11	889.25	665.80	18.11	22.42	2024.00	809.60	78.90%	86.92%	0
13:3	2.59	49.39	30.42	219.07	877.23	649.13	17.75	219.19	2005.00	802.00	79.24%	87.17%	0
13:4	2.22	49.55	30.70	215.00	859.72	630.67	17.39	0.00	1980.00	792.00	79.73%	87.76%	0
14:1	1.87	49.88	30.98	213.62	855.38	620.80	16.27	0.00	1944.00	777.60	78.79%	86.83%	0
14:2	2.27	47.80	31.28	203.86	816.52	584.27	16.13	19.15	1906.00	762.40	80.95%	88.51%	0
14:3	2.30	47.34	30.99	196.95	788.89	548.20	16.46	38.30	1825.00	730.00	80.23%	87.58%	0
14:4	2.05	47.88	31.01	189.95	760.16	520.20	16.53	7.33	1754.00	701.60	79.95%	87.45%	0
15:1	1.75	45.99	31.44	180.73	724.65	484.80	15.75	0.00	1674.00	669.60	80.19%	87.10%	0
15:2	2.30	44.51	31.33	170.69	684.26	442.27	15.51	95.39	1576.00	630.40	79.94%	86.34%	0
15:3	2.10	44.35	31.19	160.33	642.47	402.40	15.57	28.93	1462.00	584.80	78.95%	85.21%	0
15:4	2.33	41.86	31.19	148.67	596.65	358.47	15.41	45.73	1350.00	540.00	76.62%	84.06%	0
16:1	1.91	41.25	31.19	135.70	544.70	311.80	15.33	90.91	1220.00	488.00	77.84%	83.02%	0
16:2	2.37	38.99	31.12	118.23	475.45	255.73	14.96	5.47	1080.00	432.00	79.09%	83.62%	0
16:3	2.57	36.66	30.95	96.88	389.67	195.27	15.01	86.82	829.00	331.60	74.24%	77.79%	0
16:4	1.60	34.83	30.62	70.86	306.93	143.86	15.44	76.91	531.00	212.40	64.88%	67.50%	0
17:1	1.56	32.61	30.19	52.45	212.88	92.47	15.59	63.97	350.00	140.00	57.76%	59.58%	0
17:2	1.75	29.57	29.68	26.61	117.56	48.14	15.94	103.66	226.00	90.40	73.53%	74.91%	0
17:3	0.84	27.22	28.80	4.19	52.66	21.40	16.82	0.00	100.00	40.00	206.71%	208.59%	0

Note: Explicit Removal (0- considered, 1- Not considered)



Remarks: [to be recorded, if any]

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3 LIQUIDATED DAMAGES FOR SHORTFALL IN PR

For every 0.01 shortfall in PR below the committed PR value, a penalty of 1% of the total Contract Value (i.e., total sum of all the Supply, Service and absolute value of O & M Contract) shall be levied. In case the Contract Performance Security has already been encashed on account of any default/delays, the penalty amount will be recovered from any due payments to the contractor. In case the Plant PR Shortfall is more than 0.05 than the specified PR value, then the total plant will be accepted on as-is basis & the total Contract Performance. Security submitted by the contractor will be forfeited & payments linked to operational acceptance will not be made.



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Annexure – D

Plant Documentation, Commissioning and Test Procedure

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1 INTRODUCTION

This document lays down the procedures, requirements and templates for conducting commissioning tests and inspection of the Plant Facilities after installation and for subsequent re-inspection, maintenance or modifications in accordance with the Tender Specifications, IEC 62446 standard (Part 1: Grid connected systems – Documentation, commissioning tests and inspection)- and industry best practices.

2 CODES AND STANDARDS

The Testing and Commissioning Procedures shall, in general, comply with the following standards:

1. IEC 62446 standard (Part 1: Grid connected systems – Documentation, commissioning tests and inspection).
2. IEC 60364-6:2016 - Low voltage electrical installations - Part 6: Verification.
3. IEC 61829:2015: Photovoltaic (PV) array - On-site measurement of current-voltage characteristics.
4. IEC 60904-4:2019 Photovoltaic devices - Part 4: Reference solar devices - Procedures for establishing calibration traceability
5. IEC TS 60904-1-2:2019 - Photovoltaic devices - Part 1-2: Measurement of current-voltage characteristics of bifacial photovoltaic (PV) devices
6. IEC 62305-3– Protection against lightning - Part 3: Physical damage to structures and life hazard
7. IS/IEC 61557 : Part 2 : 2007 - Electrical safety in low voltage distribution systems up to 1000 V ac and 1500 V dc - Equipment for testing, measuring or monitoring of protective measures: Part 2 insulation resistance

3 COMMISSIONING

3.1 GENERAL

3.1.1 Objective

The Commissioning Procedure defined in this document aims to:

- Verify that the power plant is structurally and electrically safe
- Verify that the power plant is structurally and electrically robust to operate for the



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specified lifetime of a project

- Verify that the power plant operates as designed and its performance is as expected

3.1.2 General Requirements before Starting the Commissioning Process

- The modules shall be stabilized (sufficiently exposed after 200 kWh/m² reaching the PV plane)
- The tests shall be conducted under stable weather conditions
- The process shall be witnessed by the Owner or their duly appointed representative.
- Soiling losses shall not be accounted for in the assessment of Results. Therefore, adequate Module cleaning exercise shall be undertaken prior to commencement of Commissioning process.
- The following equipment shall be used during the commissioning process (Refer Section VII B: Technical Specifications for testing instruments):
 - Earth resistance tester
 - IV curve tracer
 - Insulation tester
 - Digital multimeter
 - Clamp meter
 - Infrared camera
 - Digital lux meter
 - Electroluminescence camera, power supply and accessories
- All testing equipment shall possess valid calibration certificate issued from approved laboratories.

4 Cold Commissioning

4.1 DC COMMISSIONING

4.1.1 Visual Inspection

The visual inspection shall be conducted on 5% of the system split in subareas equally distributed in the field. Unless otherwise specified, Approved Cat I Drawings shall be referred for correctness/verification. At least following aspects shall be verified visually on the DC side:

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- Sizing of the DC fuses for running conditions, for the maximum voltage and the maximum current.
- Sizing of the string cables including overcurrent protection considering the current carrying capacity under operating conditions
- Cables protected against mechanical damage
- Functionality of the main DC switch
- Fixation of the modules to the mounting structure
- Termination of the cables to the inverter
- Where the PV system includes functional earthing of one of the DC conductors, the functional earth connection shall be specified and installed to the requirements of IEC 62548.
- Laying and installation of cables
- Fixation of the grounding electrodes
- Grounding of all conductive parts and connected to the equipotential bonding system of the PV plant
- The torque values in the mounting structure, combiner boxes, bars and joints shall match the manufacturer specifications
- Where protective earthing and/or equipotential bonding conductors are installed, they shall be parallel to and bundled with the DC cables
- Electrical circuits and devices shall be labelled.
- The PV modules shall be in a good condition (no visible serial defects such as yellowing, delamination, scratches, etc.).
- Functioning of fire protection equipment.

Acceptance criteria

Each deviation from industrial best practices, norms, standards and good workmanship shall be documented in a punch list. All items shall be categorized as “critical”, “important” or “minor”.



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4.1.2 Pre-Energizing Tests

4.1.2.1 Measuring instruments and monitoring equipment and methods shall be chosen in accordance with the relevant parts of IEC 61557 and IEC 61010. The following tests shall be carried out on the DC circuit forming the PV array in accordance with a Sampling Plan:

- Electrical Continuity test: This test shall be performed on the earthing and/or equipotential bonding conductors, in the PV array field. Connection of such conductors to earthing pit shall also be verified .
- Polarity test: Polarity of DC cables shall be verified. After verifying the correctness of polarity, marking on cable shall be checked for correctness
Note: Polarity test shall be performed before closing the switches or string overcurrent protective devices are inserted
- Combiner box test: The purpose of this test is to ensure all strings are connected correctly to the combiner box. The test procedure is as follows and shall be performed before any string fuses / connectors are inserted for the first time:
 - i) Select a volt meter with voltage range at least twice the maximum system voltage.
 - ii) Insert all negative fuses / connectors so strings share a common negative bus.
 - iii) Do not insert any positive fuses / connectors.
 - iv) Measure the open circuit voltage of the first string, positive to negative, and ensure it is an expected value.
 - v) Leave one lead on the positive pole of the first string tested, and put the other lead on the positive pole of the next string. Because the two strings share a common negative reference, the voltage measured should be near-zero, with an acceptable tolerance range of ± 15 V.
 - vi) Continue measurements on subsequent strings, using the first positive circuit as the meter common connection.
 - vii) A reverse polarity condition will be very evident if it exists – the measured voltage will be twice the system voltage.
- String open circuit voltage test, V_{oc} (under stable weather conditions): The purpose of this test is check the modules connection in string as per the design. The V_{oc} of PV string should be measured using suitable measuring device before closing any switch or string overcurrent protective devices, where fitted.



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The measured string V_{oc} will be assessed to ensure it matches the expected value (typically within 5 %) in one of the following ways:

- a) Compare with the expected value derived from the module datasheet or from a detailed PV model that takes into account the type and number of modules and the module cell temperature.
 - b) Measure V_{oc} on a single module, then use this value to calculate the expected value for the string.
 - c) For systems with multiple identical strings, voltages between strings can be compared.
- String circuit current test, I_{sc} (under stable weather conditions): The purpose of this test to check the correctness of system, operational characteristic and PV array wiring. These tests are not to be taken as a measure of module / array performance. The test procedure will be as follows:
 - i) Ensure that all switching devices and disconnecting means are open and that all PV strings are isolated from each other.
 - ii) Create a temporary short circuit into string under test by using any of the following method:
 - (a) use of a test instrument with a short circuit current measurement function (e.g. a specialized PV tester);
 - (b) a short circuit cable temporarily connected into a load break switching device already present in the string circuit;
 - (c) use of a “short circuit switch test box” – a load break rated device that can be temporarily introduced into the circuit to create a switched short circuit.
 - iii) Measure the short circuit current (I_{sc}) using a suitably rated measuring instrument.
 - iv) After taking the reading, interrupt the short circuit using a suitable load break switching device and check the zero value of current before changing any other connections.
 - v) Compare the measure value of I_{sc} with the expected value. For systems with multiple identical strings, measurements of currents in individual strings shall be compared. These values should be the same (typically within 5 % of the average string current).
- Note: An I-V curve test can be performed as an alternative to this test (see 4.3).
- Functional tests: The following functional tests shall be performed:

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- i) Switchgear and other control apparatus shall be tested to ensure correct operation and that they are properly mounted and connected.
- ii) All inverters forming part of the PV system shall be tested to ensure correct operation. The test procedure should be as defined by the inverter manufacturer.

Functional tests that require the AC supply to be present (e.g. inverter tests) shall only be performed once the AC side of the system has been tested.

- Insulation resistance of the DC circuits: Test procedure to conduct this test will be as follows:
 - i) Before commencing the test adopt the following safety measure to avoid any potential shock hazard
 - (a) Isolate the testing area.
 - (b) Do not touch any metallic surface, module backsheet or the module terminals when performing the insulation test.
 - (c) Appropriate personal protective clothing / equipment should be worn for the duration of the test.
 - ii) Isolate the PV array from the inverter (typically at the array switch disconnecter)
 - iii) Disconnect any piece of equipment that could have impact on the insulation measurement (i.e. overvoltage protection) in the junction or combiner boxes.
 - iv) The insulation resistance test device shall be connected between earth and the array cable(s) or combiner bus bar. Connections can be made between earth and array negative followed by a test between earth and array positive or between earth and short circuited array positive and negative.
 - v) Follow the IR test device instructions to ensure the test voltage and readings in megaohms. When the system voltage (V_{oc} at STC $\times 1.25$) is higher than 500V, the test voltage shall be 1,000V and the minimum insulation resistance 1 M Ω .
 - vi) Ensure the system is de-energized before removing test cables or touching any conductive parts.

4.1.2.2 Sampling Plan:

At least 2 strings from 2 SMUs shall be randomly chosen by the Owner connected to each Inverter.

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Acceptance criteria

The DC commissioning will be passed when the aforementioned verifications are successfully passed in 100% of the sample according to the IEC 62446: 2016 – 5 and IEC 62446:2016 – 6.

4.2 AC COMMISSIONING

4.2.1 Visual Inspection

The visual inspection shall be conducted on 5% of the system. In general, the requirements specified in the IEC 60364-6 -6.4.2 apply. At least following aspects shall be verified visually on the AC side:

4.2.1.1 General requirements

- Protective requirements against electric shock
- Protection against fire and heat
- Choice, setting, selectivity and coordination of protective and monitoring devices
- Sizing of cables regarding voltage drop and ampacity as per approved Drawings.
- Sizing of protective and monitoring devices as per approved Drawings
- The circuit breakers are correctly located
- Selection, location and installation of suitable isolating, overvoltage protective devices and switching
- The equipment and protective measures are appropriate for the external influences and mechanical stresses
- The diagrams, warning notices or similar information attached to the wall inside the inverter housing or the control room
- Proper fixation of the cables to the collector bars in the AC combiner box
- Proper labelling of all electrical circuits and devices including the neutral conductor and protective conductor as well as correct connection of single pole devices to the phase conductors
- Adequacy of termination and connection of cables and conductors
- The warning labels and technical documentation physically displayed
- Selection and installation of earthing arrangements, protective conductors and their



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connections

- The existence and correct use of protective conductors and protective equipotential bonding conductors (PEB)
- Measures against electromagnetic disturbances implemented
- Easy access to the operational devices for maintenance
- Any exposed conductive parts connected to the earthing system
- The RCD type has been selected according to the requirements of the IEC 62548
- The isolation means of the inverter on the AC side are functional and correctly sized
- The fire protection requirements according to the approved design shall be given

4.2.1.2 Requirements for the inverter

- Installation as per manufacturer's instructions and compliance with IEC 62548
- Inverters properly fastened to the ground
- Inverter properly earthed
- Inverter incoming/outgoing cables properly isolated, labelled and connected
- The connections for phase sequence L1, L2, L3 and N in the correct order
- All cable terminations properly done
- Nameplate data. The minimum requirements for the production of a name plate are –
 - name and origin of the manufacturer; –
 - model or type name;
 - serial number;
 - electrical parameters: V_{dcmax} , V_{mppmin} , V_{mppmax} , I_{dcmax} , $P_{ac,r}$, $V_{ac,r}$, f_r , I_{acmax} ;
 - degree of protection;
 - overvoltage category;
 - safety class.
- The displays - check / readout show plausible results
- The filters are clean and properly maintained
- The cooling outputs of the inverters are free from obstruction
- The DC circuit breaker is functional
- The DC insulation monitoring correctly installed
- The fuses at the DC entrance correctly sized



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- The location of the inverter(s) in the field matches the approved design
- Protection against self-loosening of clamps and screws
- The string inverter anchored to the mounting structure
- The mechanical assembly is robust
- The inverters are fixed to non-flammable mechanical elements

Acceptance criteria

Each deviation from industrial best practices, norms, standards and good workmanship shall be documented in a punch list. The punch list shall represent a maximum budget of 1% of the construction price and all items shall be categorized as “critical”, “important” or “minor”.

4.2.2 Pre-Energizing Tests

Measuring instruments and monitoring equipment and methods shall be chosen in accordance with the relevant parts of IEC 61557 and IEC 61010. The following tests shall be carried out on the AC circuit forming the PV array:

- Continuity of conductors. The requirements in IEC 60364-6:2016 – 6.4.3.2 apply
- Insulation resistance of the electrical installation. The requirements in IEC 60364-6:2016 – 6.4.3.3 apply
- Insulation resistance testing to confirm the effectiveness of protection by SELV, PELV or electrical separation. The requirements in IEC 60364-6:2016 – 6.4.3.4 apply
- Insulation resistance/impedance of floors and walls. The requirements in IEC 60364-6:2016 - 6.4.3.5 apply
- Polarity test. The requirements in IEC 60364-6:2016 - 6.4.3.6 apply
- Testing to confirm effectiveness of automatic disconnection of supply. The requirements of the IEC 60364-6:2016 – 6.4.3.7 apply
- Testing to confirm the effectiveness of additional protection. The requirements of the IEC 60364-6:2016 – 6.4.3.8 apply.
- Test of phase sequence. The requirements of the IEC 60364-6:2016 – 6.4.3.9 apply
- Functional tests. The requirements of the IEC 60364-6:2016 – 6.4.3.10 apply
- Voltage drop. The requirements of the IEC 60364-6:2016 – 6.4.3.11 apply



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Acceptance criteria

The AC commissioning will be passed when the aforementioned verifications are successfully passed in 100% of the sample according to the IEC 62446: 2016 – 5 and IEC 60364 – 6.

4.2.3 Additional Pre-Energizing Tests

All of the below tests shall be conducted in accordance with the supplier's installation/commissioning manuals.

4.2.3.1 Distribution boards and combiner boxes

Site testing on distribution boards shall include:

- Mechanical functional test of all components including mechanical interlocks
- Electrical functional test of all control and protection wiring against the approved switchgear schematics
- Power frequency overvoltage test (flash test) on the switchgear including circuit-breakers in the test circuit
- Low resistance ductor test on the switchgear including circuit-breakers in the test circuit
- Visual inspection
- Verification of earthing

4.2.3.2 Inverters

Site testing on inverters shall include:

- Full test procedure as defined by the inverter manufacturer
- A full mechanical functional test of all components including mechanical interlocks
- Verification that the inverter operational parameters have been programmed to local regulations
- Electrical functional test of all control and protection wiring against the approved switchgear schematics as per approved MQP/FQP
- Insulation resistance test and earth residual current monitoring test
- Anti-islanding functionality
- High Voltage overvoltage test
- SCADA and metering calibration & functionality test



4.2.3.3 HT Switchgear

Site testing on outdoor circuit-breakers shall include:

- Functional check of all wiring, interlocks, auxiliaries and pressure devices
- Timing test and travel curve
- Visual inspection

4.2.3.4 LV/MV transformers

Transformer commissioning shall include:

- Visual inspection, alignment, earthing and labeling
- Functional check of all wiring against the approved transformer schematics
- Testing and calibration of all transformer protection and monitoring devices
- Insulation resistance test
- Functional test of off-circuit/on Circuit tap changer and check of the continuity of all windings

4.2.3.5 Substation/Power Transformers

- Ratio measurement on all tap changer settings
- Winding resistance measurement on highest, lowest and nominal tap settings
- Insulation resistance between all windings, and each winding to earth
- Insulation resistance core-to-earth
- Oil sample tests: breakdown strength, moisture content, and dissolved-gas content
- Transformer differential protection scheme testing

Acceptance criteria

The test results shall be aligned with the manufacturer specifications stated in the installation manual.

4.3 IV CURVE TESTING

The requirements of the IEC 62446-1:2016 – 7.2 apply. Following normative references shall be considered while performing the IV curve test:

- IEC 61829:2015 Photovoltaic (PV) array - On-site measurement of current-voltage characteristics
- IEC 60891:2009 Photovoltaic devices - Procedures for temperature and irradiance



corrections to measured I-V characteristics

2 % of the module strings shall be measured. If $\Delta P_{\text{stringN}} > 5\%$, all the modules within that string shall be I-V characterized. Modules with $\Delta P_N > 5\%$ shall be replaced. If more than 5% of the measured strings of the first sample show $\Delta P_N > 5\%$, another 2% shall be inspected. If more than 5% of the measured strings in the second sample show $\Delta P_N > 5\%$, another 5% shall be inspected. If more than 5% of the measured strings in the third sample show $\Delta P_N > 5\%$, another 10% shall be inspected. If more than 5% of the measured strings in the fourth sample show $\Delta P_N > 5\%$, another 10% shall be inspected. The reference power value is the flash list value minus the light induced degradation (LID) value in the datasheet/module warranty.

Acceptance criteria

The power determination analysis will be passed when less than 5% of the modules measured in the last sample show $\Delta P_N < 5\%$.

5 Hot Commissioning

5.1 INFRARED INSPECTION

Following normative references apply:

- PV array infrared camera inspection procedure (IEC 62446-1:2016 - 7.3) and IEC 62446-3 TS Ed.1.0 - Photovoltaic (PV) systems - Requirements for testing, documentation and maintenance - Part 3: Outdoor infrared thermography of photovoltaic modules and plants (draft)
- The infrared inspection shall be applied both to the PV modules and the BOS components. The inspection sample will depend on the project size and shall be agreed with the OWNER. The following values serve as an orientation:
 - Large scale ground mounted PV plants
 - PV modules: 100%
 - Inverters: 100%
 - Combiner boxes: 100%



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Acceptance criteria

The following conditions shall be met simultaneously:

- 0.2% or less of the inspected modules show thermal gradients at the cell level of $T > 10\text{ K}$
- 0.2% or less of the inspected modules show thermal gradients at the junction box level of $T > 10\text{ K}$
- 0.2% or less of the inspected modules show inactive cell strings
- No PID is detected
- All module strings are connected and producing
- All inverters are connected and producing

5.2 INVERTER AVAILABILITY TEST

5.2.1 Calculation of the Operation Time

It shall be calculated on inverter level. The operation time starts as soon as the inverter switches on. Therefore only the logged irradiation values during the operation time of the inverter shall be considered. Irradiation values logged before or after the inverter running time shall be disregarded.

5.2.2 Calculation of the Downtime

The downtime relevant for the availability calculation is any time in which a part or a subpart of the system is not operational. The outage periods shall be considered again on inverter level. Only complete outages shall be taken into consideration. System black-out periods due to following reasons shall not flow into the calculation (i.e. excluded events):

- A failure in the distribution grid or the transformer substation, making it impossible to transmit the generated power
- Solar radiation below the level needed to obtain the minimum operating voltage to start the inverter operation
- Causes of Force Majeure.
- Occurrences of anomalies in the power supply system (frequency differences or voltage surges) that trigger the protective systems of the plant or the limit settings of the inverter

Any forced disconnection shall be documented and recorded.



Acceptance criteria

The system availability shall be at least 99% during the testing period.

5.3 SINGLE AXIS TRACKER AVAILABILITY TEST (IF APPLICABLE)

The tracker availability test shall be carried out in parallel to the inverter availability test and shall have the same duration. During the test, all trackers shall follow the sun according to the angles established in the tracking mechanism. A loss of availability shall be considered when the angle of inclination of one or more trackers deviates by more than 2° from the theoretical angle. The angles of inclination of each tracker shall be recorded with a resolution of 1min via the SCADA system.

Acceptance criteria

The tilt angle of each tracker shall lie within a $\pm 2^\circ$ range during 99.5% of the operational time.

5.4 SCADA AND WEATHER STATION RELIABILITY

5.4.1 Visual Inspection

- Installation of the communication system architecture diagram according to the specifications
- Functional Tests conducted during FAT for Pre-Dispatch Inspection shall be repeated.
- SCADA shall be linked to all protection relays, disturbance recorders and other substation equipment using the communications protocol
- Visual check on the assembly of all joints and on the as-installed condition of all components, including:
 - The irradiation sensor is not shaded and is installed at the correct tilt angle and under CCTV coverage.
 - Ambient temperature and module temperature sensor are installed properly (Reference IEC 61724)
 - Mechanical anchorage of the sensors is robust
- Complete calibration certificates of all the instruments shall be provided



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Acceptance criteria

Each deviation from industrial best practices, norms, standards and good workmanship shall be documented in a punch list. The punch list shall represent a maximum budget of 1% of the construction price and all items shall be categorized as “critical”, “important” or “minor”.

6 Battery Energy Storage System

6.1 VISUAL INSPECTION

Before energizing the BESS, following visual checks shall be made to check the required design compliance:

- Installation of protective cover for live, hot and cold parts, and the adequate distance from the person;
- Installation of fence, wall, locking system of doors and access panels, and notice boards
- Installation of ventilation system;
- Installation of firefighting system;
- Installation of lightning protections devices.
- Wiring
 - All wiring shall be continuous and without splices.
 - Wiring that may be exposed to mechanical damage are placed in conduit or armoured.
 - Wires have permanent and durable identifying labels or markings on both ends.
 - Control and instrumentation wiring shall be separated from power and high-voltage wiring by use of separate compartments or enclosures or by use of separate wireways and appropriate barrier strips.
 - BESS and PCS control and instrumentation system wiring shall be bundled, laced, and otherwise laid in an orderly manner.
 - Cable systems do not block access to equipment by personnel. There are no exposed current-carrying or voltage-bearing parts.

6.2 CONTINUITY TEST

Continuity of power, control and auxiliary circuit in the system shall be verified through visual inspection, continuity tester and insulation resistance test.

Phase sequence and terminal marking shall also be verified with drawing and design documents.



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6.3 EARTHING TEST

Following element to be check according to the design and applicable standards:

- Proper connection of the earthing busbar to the local earthing busbar;
- Individual earthing connection of main equipment to the earthing busbar;
- Connection of earthing cables to structures via proper connectors to prevent corrosion from dissimilar metals.

6.4 INSULATION TEST

For low-voltage EES systems, the insulation resistance test and withstand voltage test shall be performed according to IEC 60364-6.

For EES systems exceeding 1 kV AC or 1,5 kV DC, the withstand voltage test shall be performed according to IEC 61936-1.

6.5 FUNCTIONAL TEST

6.5.1 Start and stop test

Check start and stop operation of BESS system with the startup/shutdown command manually and automatically.

6.5.2 Alarms Functional Test

Alarms initiation from the BESS in case of following conditions:

- Emergency trip switch.
- Loss of the low-voltage AC or utility grid voltage.
- An AC circuit breaker trip (either side of transformer).
- Door interlock: Initiate shutdown when the door is opened (with appropriate provision for maintenance work). Interlocks shall be self-resetting.
- Smoke/fire alarm.
- Control logic trouble.
- A DC ground fault (simulated).
- Remote disable (no reset required).
- grid system faults (balanced and unbalanced; line-to-ground, line-to-line, and three-phase).
- Abnormal voltage
- Islanding condition.
- Protection or control scheme failures, including the following:
 - Failure of local interconnection protection system
 - Failure of critical breaker trip coil or interrupting device
 - Loss of DC supply



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6.5.3 Load tripping test

Check the interlock of BESS with the main

6.5.4 Operating cycle test

Check for any abnormalities such as rise in temperature, noise level and vibration in ESS system during rated input and output power operation.

6.5.5 Storage Settings

Verification of settings/control points and provision for modification of various set points and fixed operation/control settings associated with the various control functions.

Operator Controls:

- Trip/reset for the BESS AC circuit breaker or contactor.
- Trip/reset for DC circuit breaker(s)/contactor(s).
- PCS on/off.
- Reset cut-out selector switch to disable remote or local reset signals.
- A selector switch to manually set the operating state (that is, the shutdown, disconnect, or operate state) and to have the control system set the operating state automatically.
- A selector switch to manually set the operating mode and to have the control system set the operating mode automatically.

6.5.6 Communication test

Verified that measuring, alarm, fault indication, message and control and monitoring system operations are correct transmitted and received by the SCADA system.

6.6 SYSTEM RATING VERIFICATION

BESS rating including rated power, energy available at rated power, and the performance of the BESS associated with different performance metrics mentioned herein taken at the beginning of life shall be based on a set of ambient operating conditions specified by the BESS Original Equipment Manufacturer (OEM) for the Project site. The Contractor shall also provide an indication of how the performance of the BESS with respect to the metrics is expected to change over time, to account for time and use of the system, and report the same periodically.

An energy capacity test shall be performed at the time of Commissioning, in accordance with procedure mentioned below and is intended to be used to determine the dispatchable energy capacity of the BESS at the time of commencement of Operation. In conducting the energy capacity test, the Contractor shall provide a detailed and documented charging procedure within the specifications of the BESS. The energy capacity tests conducted on the BESS shall be documented to allow for tracking performance degradation.



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Available/Dispatchable/Throughput energy shall be tested in accordance with the following procedure under the standard testing conditions specified in IEC 62933-2-1 (Cl. 5.1.3):

Measurement:

System shall be charged to the full available energy level. Subsequently, the BESS (appropriate modular sub-unit thereof) shall be discharged and charged at rated power between the lower and upper SOC* limit (as recommended by the OEM for current application). Power during charge and discharge shall be recorded at regular intervals of time documented by the OEM to provide a statistically valid resolution. The associated energy input (Ei), including all BESS functional, parasitic and auxiliary consumption and energy output (Eo) of the BESS shall be calculated from the recorded power. Discharged energy should be recorded as per the readings in the ABT Meter(s) at the point of interconnection of the BESS with the Solar PV array,

** SOC recorded, shall be as reported by the Battery Management System.*

The above process shall be repeated multiple times, with minimum rest period between charging and discharging, if so recommended, so as to record data for a specified no. of cycles (n). The reference performance test value for stored energy shall be calculated as the mean of the values of Eo and Ei as measured for discharge and charge respectively.

The procedure shall be repeated (one cycle each) with power levels at 75%, 50%, and 25% of rated power and documented.

Criterion: BESS stored Energy capacity shall be at least total energy dispatchable as specified in the Section V: Technical Specifications at rated Power at the time of commissioning.

2. Round-trip energy efficiency (RtE, η) shall be determined as a function of the charge and discharge power and calculated using the following formula:

$$\eta_p = \frac{\sum E_o}{\sum E_i}$$

where,

$\sum E_i$ is the sum of Energy input to the BESS over n cycles

$\sum E_o$ is the sum of Energy output from the BESS over n cycles η_p is the Round Trip Efficiency at charge/discharge Power, P (expressed as a percentage of rated power)

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E_o and E_i shall be determined as per point 1. above.

Criterion: η_p , as determined through the process described above shall be >80% at the time of commissioning.

Note: The tests are intended to be carried out over a continuous period. The value of n shall be at least 3 for 100% rated Power and 1 for 25%, 50% and 75% of rated power as per procedure laid down in Annexure B.

3. BESS Response time: shall be measured as the sum of the following two entities: 1-> The time elapsed between the instant when a command to change set point from rest to discharge is sent to the BESS (T₀) and the instant when the BESS starts responding to the discharge command signal (T₁), the BESS being in active standby state and 50% SOC at T₀ i.e., T₁- T₀
- 2-> Time elapsed in seconds between the instant the ESS output transitions from no discharge i.e. 0% (T₁) to discharge and the instant it attains rated power capacity(T₂) (or from no charge (T₁) to charge state and the instant it attains rated charge rate(T₂)) i.e. T₂- T₁

$$RT = (T_2 - T_1) + (T_1 - T_0) = T_2 - T_0$$

Where T₀ , T₁ and T₂ are timestamps:

T ₀ :	Instant when a command to change set point is received at BESS boundary (to be identified in advance);
Data Format:	dd/mm/yyyy hh:mm:ss.00
T ₁ :	Instant when the BESS starts responding to the Command signal;
Format:	dd/mm/yyyy hh:mm:ss.00
T ₂ :	Instant when the BESS attains 100% of full discharge rate when discharging or full charge rate;
Format:	dd/mm/yyyy hh:mm:ss.00



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ANNEXURE – E

MANDATORY SPARES

S. No.	Equipment/Material	Quantity (for each type and rating)
1	PV Modules	0.5% of total supply
2	MC4 connectors (including Y-connector if used)	1% of total supply
3	String Combiner Box	1% of total supply
4	Power Conditioning Unit (As applicable)	
	(i) Central Inverter	As per OEM recommendation
	(ii) String Inverter	1% of total supply
5	Inverter Transformer	
	(i) HV bushing with metal parts and gaskets	1 set
	(ii) LV bushing with metal parts and gaskets	1 set
	(iii) WTI with contacts	1 set
	(iv) OTI with contacts	1 set
	(v) Buchholz relay	1 set
	(vi) Magnetic Oil Gauge	1 set
	(vii) Complete set of gaskets	1 set
6	HT Switchgear	
	(i) Vacuum pole	1 no.
	(ii) Closing coil	1 no.
	(iii) Tripping coil	1 no.
	(iv) Spring charging motor	1 no.
	(v) Relay	1 no.
	(vi) Meter	1 no.
	(vii) Current Transformer	1 no.
	(viii) MCCB	1 no.
	(ix) MCB	1 no.
	(x) Fuse	10% of total supply
	(xi) Indicating lamp	10% of total supply
	(xii) Rotary switch	10% of total supply

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**Signature of
Bidder**

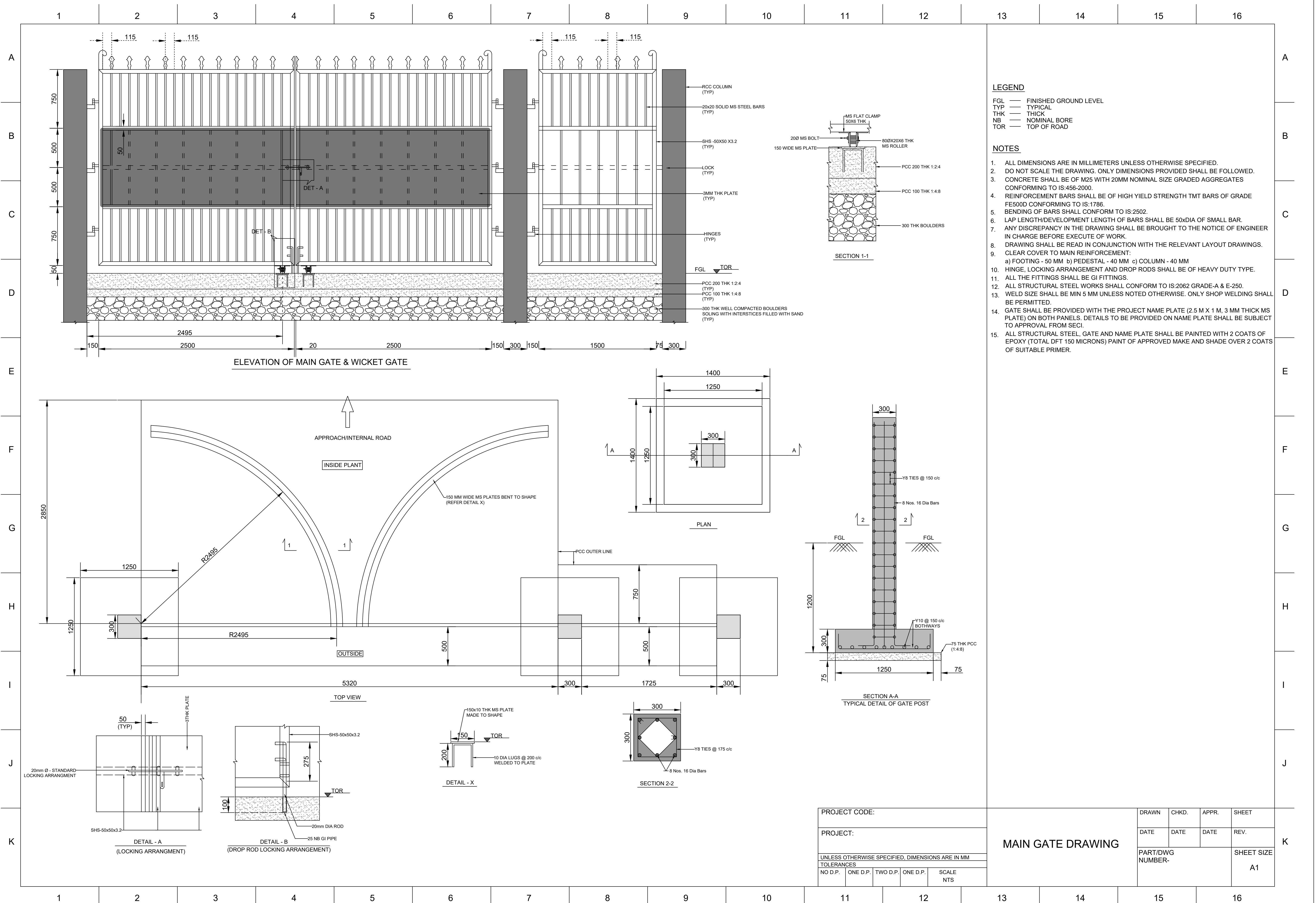


Tender for Design, Engineering, Supply, Construction, Erection, Testing, Commissioning and O&M of 5 MW Grid Connected Solar PV Power Plant at VOCPT, Tuticorin



S. No.	Equipment/Material	Quantity (for each type and rating)
7	LT Switchgear	
	(i) MCCB	2 nos.
	(ii) MCB	2 nos.
	(iii) Fuse	10% of total supply
	(iv) Relay	2 nos.
	(v) Meter	2 nos.
	(vi) Current Transformer	2 nos.
	(vii) Voltage Transformer	2 nos.
	(viii) Indicating lamp	10% of total supply
	(ix) Rotary switch	10% of total supply
8	Solar Cable	1% of total supply
9	DC Cable	1% of total supply
10	AC Cable	1% of total supply
11	Communication Cable	1% of total supply
12	Control Cable	1% of total supply
13	Fuse	10% of total supply
14	22 kV line / pole accessories	
	(i) Line supports, MS Angle, Back Clamp, Top Clamp, Earthing Coil, Insulators	2 set
	(ii) Conductor	1 km
	(iii) Jointing Sleeves, Stay set complete with turn buckles, stay wire, stay insulators, Anti-climbing Devices, Danger Boards	2 set

Spares, if used, during the O&M period shall be replenished by the Contractor. All the mandatory spares shall be handed over to the Employer in working condition at the end of O&M period.





Tender for Design, Engineering, Supply, Construction, Erection, Testing, Commissioning and O&M of 5 MW Grid Connected Solar PV Power Plant at VOCPT, Tuticorin



Annexure – G

Operation & Maintenance Agreement

**5 MW (AC) Grid Connected
Solar PV Plant at VOCPT,
Tuticorin**

**Tender No.
SECI/C&P/NIT/2021/VOCPT5**

**Annexure – G
Page 1 of 46**

**Signature of
Bidder**

1 CONTRACTOR'S OBLIGATIONS

1.1. Services

During the Term of the Contract, the Contractor shall perform the services in accordance with the Operation and Maintenance Scope of work as described in Annexure 1 (Scope of Work for Operation and Maintenance) (hereafter the "Services"), and also in accordance with the other conditions as prescribed related to the operational performance under Section - VII of the Bid Document:

- 1.2. The Contractor shall be deemed to have allowed correct and sufficient O&M Price to cover all its obligations under the Contract and to have allowed the necessary resources to enable it to perform the Services to the standards and in the manner required. The Contractor's failure to acquaint itself with or assess any applicable condition shall neither relieve it from the responsibility for performing its obligations under the Contract nor entitle the Contractor to any additional costs or any other relief.
- 1.3. To the extent the Contractor reasonably believes that it is necessary to enhance the overall performance or safety of the Plant, the Contractor may propose changes and improvements to the Plant [(including the software included with respect thereto)]. The Contractor shall ensure that no modification of any equipment, change of software settings or any other alteration of equipment shall:
 - (i) cause a negative impact on the performance of the safety and reliability of the Plant;
 - (ii) adversely impact the Warranties;
 - (iii) adversely affect the warranties provided by the Contractors under the Contract;
 - (iv) conflict with the requirements under the contract; or
 - (v) bypass any protective equipment.
 - (vi) Violates any National/International Trade & IPR laws.
- 1.4. Any proposed modifications/changes shall not be carried out without the approval of the original equipment manufacturer and the Employer and in accordance with Performance Standards, and Technical Specifications. The Employer shall be notified of the proposed modifications along with reasons and technical note for such modifications, changes, alterations, etc., and after the modifications are carried out in accordance with the contract, an alterations activity report is to be shared with the Employer.

- 1.5 The Contractor shall, while rendering the Services, observe and comply with all the Applicable Laws, Good Solar Industry Practices, Ministry of New & Renewable Energy (MNRE), Ministry of Power (MoP), CEA, CERC, POSOCO, SLDC, Local DISCOM & TRANSCO guidelines and Performance Standards pursuant to the contract. The Employer shall have the right to, to the extent applicable to Services rendered by the Contractor, conduct monthly audit on Applicable Laws, health, safety and environment and all other relevant compliances. The Contractor shall provide all necessary access and supporting documents during audit which are applicable to the same. However, such audits will be planned well in advance in coordination with the Contractor, without affecting the site operation plan.
- 1.6 The Contractor shall provide and make available as necessary, all such skilled, experienced and qualified labour and other competent personnel as are required to perform the Services the Contractor shall ensure that its Personnel hold and continue to maintain all qualifications and licenses as required under Applicable Law to allow its Personnel to lawfully undertake performance of the Services and carry out the Contractor's other obligations under the contract. For works/services being performed on a continuous basis, the O&M Price shall be deemed to include and the Contractor shall obtain all required Government Approvals and bear any costs related thereto (including any shift or permitted overtime working, allowances, wage orders, night shift differentials, etc.).
- 1.7 The Contractor shall ensure that all its Personnel deployed for providing the Services have undergone adequate safety training and are appropriately skilled, qualified and experienced in performing the Services for solar farms of a similar size, scope and complexity as the Plant. The Contractor shall be responsible for all matters relating to labour relations, working conditions, training, employee benefits, safety programs and related matters pertaining to its Personnel. The Contractor shall at all times have full supervision and control over its Personnel and shall at all times maintain appropriate order and discipline among its Personnel.
- 1.8 Contractor shall be solely liable for and, at its sole cost and expense, arrange for the response, reporting, removal, transportation, disposal, investigation, cleanup or other remedial action (in all cases by licensed, insured, competent and professional contractors in a safe manner and in accordance with Applicable Laws) for any hazardous substances/waste existing at, in, on or under the Project.

- 1.9 The Contractor shall ensure availability of such Consumable Parts, Spare Parts, and Contractor's Equipment as may be necessary for the performance of the Services. The Contractor shall ensure that such Contractor's Equipment does not interfere with the operational or structural integrity of the Plant
- 1.10 The Contractor shall make available to the Employer the Reference Documents set forth in the Reference Documents and shall also provide the Employer with updates and revisions to the Reference Documents to the extent such updates and revisions are necessary and applicable to the performance of the Services. The Contractor shall provide the Employer with a latest version of update available of all the Reference Documents at the time of termination of the contract.
- 1.11 The Contractor acknowledges and agrees that other contractors of the Employer may be present at the Plant and it shall cooperate with such other contractors to allow the performance of its and their respective obligations to occur concurrently.
- 1.12 The Contractor shall through relevant agencies, if applicable, promptly investigate all accidents, damage or destruction, diagnosis, assessment of any potential consequential effects, estimating cost of repair, arranging for any remedial action required, making of any claims under the insurance policies and co-operating with and making reports required by the Employer or insurers.
- 1.13 The Contractor shall ensure that any Warranties provided under the Project Contracts are not invalidated or adversely affected by any act or omission of the Contractor during the period of such warranties.
- 1.14 The EMS and SCADA system shall be connected with the Plant and the Contractor shall make arrangements to provide monthly reports from the SCADA system. The Contractor shall arrange to connect the Plant to the SCADA system operating at the Site enabling the remote operation of the Plant by the Contractor and to provide access to information pertaining to the Plant to the Employer's Representative at Site and SLDC. The Employer may collect the data generated by the SCADA system in respect of the Plant from the Contractor.
- 1.15 Upon the expiry or earlier termination of the contract, the Contractor shall arrange to provide and install an additionally extended terminal from the SCADA system at the Site to enable the Employer to continue to access data relating to the Plant, at no Additional Cost and upon such terms as may be mutually agreed between the Parties at such time of expiry or earlier termination of the contract as the case may be.

- 1.16 The Contractor shall further provide support for the operation and maintenance of any Employer installed scope including any third-party support as may be required by any relevant Government Authority.
- 1.17 The Contractor shall notify and communicate to the Employer about any condition which may cause any malfunction or failure in the Project.

2. FUNCTIONAL GUARANTEES/WARRANTIES

2.1. Technical and Functional Performance Guarantee

- 2.1.1 The Contractor shall be responsible for meeting the performance guarantee of the Plant Facility as described in the contract.
- 2.1.2 In case of failure to meet the functional guarantees as described in section 2.1.1 above, the Contractor shall be liable to pay applicable Liquidated damages as described in the Bid Document and represented in Annexure-2 of this Annexure G.

2.2. General Repair Warranty

- 2.2.1. All repairs and replacements performed by the Contractor pursuant to the contract, shall cover a warranty for defects in materials and workmanship for the entire terms of O&M contract.
- 2.2.2. The Contractor shall disassemble, repair or, replace and reinstall any defective Equipment parts and/or re-perform any defective work covered by this warranty, at no cost or expense to the Employer.
- 2.2.3. In the event that Contractor replaces Parts that failed during the final year of the Term in accordance with its obligations under the Contract, Contractor hereby warrants to Employer that the replacement Parts installed in the Plant Equipment during such period shall not fail due to a defect for one (1) year following the date of installation of such replacement Parts; provided that in no event shall any such warranty extend beyond earlier of (i) the period that is one (1) year following the expiration of the Term or (ii) the date of any termination of the contract for reasons other than attributable to Contractor. During such period, if the contract is not in effect for any reason other than being terminated by Employer for cause, Contractor's obligation will be limited to supplying all needed Parts on to the Site delivered basis. For the avoidance of doubt, this Clause may survive the termination or expiry (as the case may be) of the contract for a period of one (1) year.

2.2.4. During Defect Liability Period if any repair and replacement are done, then the warrantee of the equipment shall be extended from the date of such repair and replacement to the period of original equipment warrantee w.r.t. that replaced component.

2.2.5 Any latent defect which may not come to knowledge or discovered in the course of normal inspection/operation during two years from the operational acceptance but, may arise within a period of 5(five) years from expiry of warranty period of two years, shall be under warranty by free replacement/rectification.

2.2.6 The acceptance of the equipment by employer shall in no way relieve contractor of his obligations under the contract.

2.3. Guarantee of compliance in relation to Curtailment Plans (acoustic or other curtailment plans)

The Employer may communicate to the Contractor any curtailment plans either linked to acoustic requirements; load management, or Applicable Law, the ("**Curtailment Plans**").

The Contractor shall ensure compliance with all Curtailment Plans provided by the Employer in accordance with Performance Standards and Technical Specifications. If either the Contractor or the Employer detects a variation with respect to the Curtailment Plans or in noise emission the Contractor will, at its own expense, characterise the problem, isolate the source of the problem and propose solutions to solve the problem to Employer (at the Employer' expenses in all cases other than cases where it's ascertained that the deviation was caused by a non-respect of the obligations under the contract).

2.4. Grid Connection and balance of electricity commitments

The Contractor acknowledges that to allow the Employer to inject the energy generated by the Plant Facility to the Grid and be eligible for the full tariff under the PPA, the Plant and the Contractor must comply with the requirements prescribed by Applicable Law, Good Solar Industry Practices, Performance Standards and the Grid documents and that failure to comply with such requirements may cause the Employer to either: (i) not be able to collect the tariff energy injected; and/or (ii) be subject to penalties payable to the Grid operator and/or the Discom and/or the power purchaser and/or any Government body. The Contractor therefore undertakes to diligently comply the requirements referred to Grid Connection and balance of electricity commitments, as prescribed under the Grid documents as provided by or on behalf of the Employer from time to time (or of which the Contractor otherwise becomes aware), and/or with the reasonable requests of the Employer associated with the compliance therewith.

3. PERFORMANCE STANDARDS

3.1 Contractor shall perform its obligations under the contract in compliance with the contract and otherwise, as applicable, in accordance with the following order of precedence (collectively, the "Performance Standards") as from time to time in force:

3.1.1 the Applicable Laws, and the requirements from the Grid Operator/SLDC;

3.1.2 the Permits and all the related documents;

3.1.3 the terms of the contract;

3.1.4 the functional Guarantee;

3.1.5 the Reference Documents including the manufacturers recommendations;

3.1.6 Employer's health and safety manuals and procedures and ESMP;

3.1.7 the Site Regulations;

3.1.8 the Equator Principles and the Equator Principles Requirements;

3.1.9 Good Solar Industry Practice;

3.1.10 Any relevant and reasonable instructions issued by the Employer, relevant to the scope of the contract, to the Contractor at least 15 days before the implementation of such instructions without any cost to the Contractor.

3.1.11 The terms of insurances directly relating to the Project and

3.1.12 Comply with all operation and maintenance obligations as set out under the PPA or do anything which results in a breach of the Employer's obligations under the PPA.

3.2 If there is any inconsistency between the Performance Standards, [it shall be interpreted in the order of precedence listed above provided that(i) the application of a Performance Standard does not derogate, breach, contradict, obstacle or circumvent the application of a Performance Standards appearing above such standard in the above order of precedence, and, in addition, (ii) provided that this such application does not cause a breach of Performance Standards or the Parties shall discuss and agree upon the manner in which such conflict shall be resolved.

3.3 Notwithstanding any other provision in the contract, the Contractor shall have no responsibility or obligation:

- (a) to save and to the extent that the Contractor is required to do so pursuant to the provisions of Additional Services, to ensure that the Plant complies with the requirements of Applicable Law, Permits, if and to the extent that the same are introduced or amended following the Commencement Date; or
- (b) subject to Additional Services, to ensure that the Plant or the Plant (as a whole or in part) complies with any noise or acoustic emissions requirements under Applicable Laws Permits.

Without prejudice to the foregoing, the Contractor is required to comply with the quality of supply limits determined in accordance with the Applicable Law and the Contractor will be deemed to have knowledge of its content.

3.4 The Contractor shall not do or omit to do anything in the performance or discharge of its obligations or the exercise of its rights under the contract or in breach of the contract, which would cause any breach of any of the terms of the Supply Contract, Works Contract, the Applicable Law, the Permits or the terms of any Permits or the Direct Contract, and should the Contractor be in breach of the Performance Standards, it shall, on demand of the Employer, indemnify the Employer against any direct Losses arising from a breach of this Clause by the Contractor, always subject to the aggregate liability cap of the Contractor (except as otherwise agreed herein).

3.5 If the Contractor is aware of a conflict between any of the above requirements, it shall inform the Employer accordingly and the Parties shall discuss and agree upon the manner in which such conflict shall be resolved.

4. **EXCLUSIONS**

4.1. General

(a) Force Majeure events as per GCC

- 4.2. The rights of the Contractor under Exclusions shall only apply to the extent that the Excluded Risk Event has caused actual delays or substantial interference to the performance of the Contractor's obligations under his Contract, which could not have been mitigated by the Contractor's best efforts, and to such portions of Contractor's obligations directly affected by such delays or interference.

4.3. Notification of Excluded Risk Event

To the extent Contractor has actual knowledge of any loss or damage to the Plant caused by or arising from an Excluded Risk Event, it shall give Employer immediate notice of the same and provide a written report to Employer within five (5) Business Days; and the employer and Contractor shall be mutually agreed upon within (30) business day. However, that any failure of Contractor to provide such notice shall not waive, prejudice or otherwise affect the other provisions in Exclusions, except to the extent that the failure to timely notify Employer results in any additional damage or loss to the Plant. Notwithstanding the foregoing, in case of delay to provide the aforementioned notice, the Contractor shall be liable towards the Employer for any additional damage or loss caused by the delay to notify the Employer.

5. **ADDITIONAL SERVICES**

- 5.1. Employer may, with respect to the Plant, request that Contractor perform work, provide services, or supply other equipment or parts, not included within Services for the successful operation of the plant for the duration of this O&M Agreement. Any such requested service or supply that the Parties mutually agree to in writing shall, subject to any specific terms and conditions agreed with respect to such service or supply, be an "**Additional Service**".

6. **SERVICE PERSONNEL**

- 6.1. Contractor shall provide the Services and any Additional Services to be performed on Site using a sufficient number of suitably skilled, qualified and experienced (including any licensing, certifications or training required by Applicable Laws or the local transmission system operator) and adequately equipped and properly trained Personnel and/or Subcontractors, all appropriately skilled and experienced in their respective trades or occupations as may be reasonably necessary to fulfil its obligations hereunder in relation to the Services and Additional Services

- 6.2. The Employer may request the Contractor to remove (or cause to be removed) any Person or Subcontractor employed on the operation of the Plant, including the Contractor's Representative if applicable, who:
- (i) engages in material or persistent misconduct or lack of reasonable care;
 - (ii) carries out duties incompetently or negligently;
 - (iii) fails materially to conform with any provisions of the Contract;
 - (iv) engages in conduct which is prejudicial to safety, health or the protection of the environment or in violation of any related Performance Standards or Applicable Laws;
 - (v) engages in conduct which might reasonably result in a breach of any provision of the contract and threaten public health, safety or security.
- 6.3. The Employer shall give notice to the Contractor of the same giving reasons and request the Contractor to replace such Personnel with a suitable candidate. The Contractor shall then as soon as reasonably possible but no later than seven (7) days upon receiving such notice from the Employer, Contractor will look in to the facts and claims of the case in all sincerity and deploy the required actions with the notice to the Employer.
- 6.4. Contractor shall have full supervision and control over its Personnel at the Site and shall maintain appropriate order and discipline among such personnel and shall cause any Subcontractor to maintain similar standards with respect to such Subcontractor's personnel at the Site.
- 6.5. The Contractor shall be responsible for all matters relating to labour relations, working conditions, training, employee benefits, employee drug testing in accordance with the Contractor's standard drug testing policy, safety programs and related matters pertaining to its employees and other Personnel engaged by the Contractor. The Contractor shall at all times have full supervision and control over its employees and other personnel engaged by it and shall at all times maintain appropriate order and discipline among its Personnel and shall cause any Subcontractor (or any subcontractor appointed by such Subcontractor) to maintain similar standards with respect to such Subcontractor's or any subcontractor appointed by such Subcontractor) employees and Personnel.

- 6.6. The Employer shall have the right, acting reasonably and following prior notification, to require the Contractor to remove from the Site any employee or Personnel of the Contractor or any of its Subcontractors (or any subcontractor appointed by such Subcontractor) engaged in activity which presents a risk of injury to persons or property at the Site.

7. SAFETY PRECAUTION

- 7.1 During performance of the Services, Contractor shall:

- 7.1.1 comply with the safety standards and any safety procedures established by Contractor and same shall be approved by employer after the Commencement Date;

- 7.1.2 take all precautions required by Applicable Laws or Site Regulations, or otherwise according to the Performance Standards, for the health and safety of Contractor, its Affiliates and Subcontractors in the performance of the Services and any other Persons with temporary or perpetual access to the Site; [provided that the foregoing shall not limit Employer's responsibility for the safety of the Site as provided in Safety Precautions.

8. CONSUMABLES, SPARE PARTS, TOOLS AND EQUIPMENT

- 8.1 During the Term, Contractor shall provide equipment Spare Parts and Consumables and Tools, all as part of the Services and without Additional Cost to the Employer in accordance with the contract. Unless otherwise specified in the contract, the Contractor shall provide the Employer with an initial Spare Parts inventory. At the end of the Term or upon termination of the contract, the Supplier will replenish the equal quantity of the Spare Parts and Consumables and Tools as provided during the start of Contract.

8.2 Consumables and Tools

Contractor shall supply Consumables and Tools to the extent required for performance of the Services. All Consumables provided by Contractor in the performance of its Services, shall be compatible with the applicable requirements of the Reference Documents and Applicable Laws.

8.3 Equipment and Spare Parts

Contractor shall supply Equipment and Spare Parts to the extent required for its performance of the Services and to maintain its obligations thereunder. The Contractor has the right to use renovated Equipment and Spare Parts. If the Contractor intends to use any refurbished Major Components, it will seek prior written approval from the Employer. Contractor's right to procure and use renovated / refurbished Spare Parts is subject to: (i) standards of good workmanship and Good Industry Practice; (ii) compliance with the applicable requirements of the Reference Documents; (iii) the Spare Part(s) are of the type being replaced or of another type insofar as same does not invalidate any applicable Type Certification of the Equipment (iv) the same warranty as equivalent new parts in terms of scope, nature and duration, (v) being renovated in conformity with the original equipment manufacturer's standards, and (v) being listed in the monthly maintenance report when used (track record of the Part). All such renovated/refurbished parts will be allowed by Employer only for any long lead items and also considering uninterrupted generation from the Project. However, the contractor shall immediately reinstate and order new items in order to replace the refurbished items provided for emergency purposes.

8.4 Inspection of Replaced Parts

Contractor shall give to the Employer seven (7) days' notice of the time when the Replaced Part is being transported to the Site. Contractor shall permit Employer to inspect, at Employer's sole cost and expense, any Part which is removed and replaced by a Spare Part pursuant to Consumables, Spare Parts, Tools and Equipment (such Part, a "Replaced Part"); provided however, any such inspection:

- (i) must not include physical alteration or disassembly of such Replaced Part; and
- (ii) must not result in any material increased costs to Contractor or delay Contractor in the performance of its obligations under the contract or any Contract with, or warranty from, its Subcontractors, unless Employer agrees to cover such material increased cost.

8.5 Tools and Equipment

Contractor shall furnish its service personnel with such tools, instruments, or materials tools and equipment and equipment as are necessary to perform the Services (the "**Contractor's Equipment**").

8.6 Prices of Consumables, Spare Parts and Contractor's Equipment

Subject to GST, Taxation & Import Duties, the O&M Price payable to Contractor under the contract shall include (in addition to other components included in such Price) the Costs of any and all Equipment, Consumables, Spare Parts and Contractor's Equipment required in connection with the performance of the Services.

8.7 Risk of Loss or Damage to Consumables, Spare Parts and Contractor's Equipment

Contractor shall:

- (i) be responsible at its own cost for the safe transportation and delivery to Site and adequate storage; of all Consumables, Spare Parts, and Contractor's Equipment, in each case, required for the carrying out of the Services;
- (ii) bear the risk of loss and damage to all such Consumables and Spare Parts during transportation to the Site and, thereafter up to the date of their incorporation by Contractor into the Plant; and
- (iii) at all material times bear all risk in any and all Contractor's Equipment on or off the Site and whether remaining separate or temporarily attached to the Plant.

8.8 Title

Contractor shall retain title to any and all Contractor's Equipment on or off the Site and whether remaining separate or temporarily attached to the Plant until transfer of Title occurs. Title to any Spare Part (or other Part) or Consumables provided by Contractor pursuant to the contract shall pass to the Employer upon:

- (i) incorporation by Contractor in the Plant free and clear of any Lien; or
- (ii) in the case of Additional Services, the date (if later) on which payment is made in full for such Spare Part or Consumable.

Title to any Replaced Part shall vest in Contractor upon such replacement, except if the Parties agree differently from time to time. In case of Additional Services, Employer shall retain title to any Replaced Part.

9. **COMMUNICATION AND REPORTING**

During the Term, Contractor shall exchange information and reports on daily, weekly, monthly, quarterly and annual basis:

9.1 Monthly Reports

Contractor shall provide Employer with the Monthly Performance Report by no later than the fifth (5th) day from the end of each month.

9.2 Emergency Notices

Upon obtaining actual knowledge thereof, Contractor shall promptly notify Employer verbally (with written notice to follow within three (3) Days) of any emergency or other hazardous condition or occurrence that Contractor reasonable believes could cause an immediate threat to the safe operation of the Plant and/or the safety of Persons.

If, by reason of an emergency arising in the course of, as a result of or otherwise in connection with and during the performance of the Services, any protective or remedial work is necessary as a matter of urgency to prevent damage to the Plant, the Contractor must immediately perform that work, provided that, Contractor shall have no obligation to perform such portions of the protective or remedial work which would be in violation with the Performance Standards, be a material breach of the contract or would cause a threat to the safety of Persons or property or would otherwise not be reasonably practicable or possible; and provided further, that Contractor shall have no obligation to retrofit or upgrade the Plant except if otherwise agreed.

Without prejudicing the liability attributable to the Contractor for failure to comply with the provisions of the paragraph above, it is clarified that if the Contractor does not perform the protective or remedial works referred to above immediately, the Employer may appoint a Replacement Contractor to perform such works. If the work (or parts thereof) which were performed or caused to be performed by the Employer is work which the Contractor was liable to do at its own expense under the contract, the costs incurred by the Employer as a result of appointing a Replacement Contractor shall be [substantiated to the Contractor on an open book basis and be] considered due and payable to the Employer and Invoices and Payment and Set Off shall apply. It is further clarified that the impact of Replacement Contractor's actions shall not be considered as an Excluded Risk Event.

9.3 Meetings

A representative of each of Contractor and Employer (the "**Representatives**") shall meet (either at the Site or alternatively at such other location as may be agreed between the Parties) at quarterly intervals or such other period as is agreed especially for the purposes set forth below:

- (i) to discuss projected dates for performance of the Services and the Additional Services in the following quarter;
- (ii) to discuss, the calculated Measured Average Availability of the Plant Facility for the past quarter under Annexure 2 [Functional Guarantees]; and
- (iii) to review the Services and Additional Services performed in the past quarter.

9.4 Visitors Log Book

Contractor shall provide Employer with a log book for the Plant to record the identity and activity of all visitors to site. Such log book will be kept at the entry Gate location of Plant. The Contractor shall cause that all personnel and representatives of each Party or any third parties visiting the [site] shall be required to record their identity, the date, time and purpose of any visit to site, the nature of any work performed thereon and such other details for which log books may reasonably be used. It is clarified that the Contractor shall not permit unauthorised third party access to the Site unless such third parties have been authorised by the Employer, are required to inspect or access the Site in accordance with Applicable Law or for performance of Services. Copies of these logs shall be provided to the Employer within ten (10) Business Days following its written request. Contractor shall create a digital back up of such logs at least every month. The log book shall be in English only.

9.5 Annual Calendaring of Maintenance Services.

At the latest two (2) months after the beginning of commencement date, each year during the Term thereafter, the Contractor shall send to the Employer the projected dates and times for the immediately following period during which the Contractor shall perform the Maintenance/Preventive Services on the Plant, with the parties using reasonable efforts to minimize any Plant downtime during Operational Sunny periods (the “**Maintenance Services Calendar**”. Such Maintenance Services Calendar may be postponed by the Employer for 5 business days); provided, that the Maintenance Services Calendar shall be developed in accordance with the Operating Manual and the terms of the contract. The dates and times in the Maintenance Services Calendar may be amended thereafter by mutual Contract of the Parties. For clarity, the Maintenance Service Calendar shall include a maintenance plan established in accordance with the Maintenance Manual.

9.6 Status Reviews

As reasonably required, or requested by the Employer, the Representatives shall meet to discuss and review (i) the information contained in the Monthly Performance Reports, (ii) the availability of the Plant, (iii) any technical issues which may have arisen with respect to the performance, availability or maintenance and servicing of the Plant Equipment, (iv) Maintenance Services and Repair Services performed during the preceding calendar month, (v) any and all failures by a Plant equipment, and (vi) Maintenance Services to occur during the next following a calendar month.

10. **Contractor's Permits**

Prior to the time in which such Permits are required in order to perform when the relevant Services and/or Additional Services, as applicable, are to be performed, Contractor shall obtain and maintain, as applicable, throughout the Term of the Contract all Permits (the "Contractor Permits") required by the Applicable Law, Good Solar Industry Practices, Performance Standards and Technical Specifications which should be issued in the name of Contractor or are otherwise attributable or necessary to the provision of the Services and/or Additional Services, other than such Permits as are required to be obtained by Employer pursuant to *Employer Permits*.

11. **Contractor's Manager**

On or prior to the commencement of the Term, Contractor shall designate a duly qualified and experienced person to manage and administer the Contractor's activities and shall provide notice thereof to the Employer, to act as its manager and coordinator of the contract on Contractor's behalf (the "**Contractor's Manager**"). The Contractor's Manager shall not have authority to amend or modify the contract or accept any commitment which would have an effect on the contract. In case the manager is on leave with prior intimation to employer, the deputy manager with equivalent qualification shall be provided at site by the Contractor

12. **Cooperation with other Subcontractors**

Contractor acknowledges and agrees that the Employer or Other Subcontractors of Employer may be present at the Site and agrees, at no cost or expense to the Employer, to reasonably cooperate with such Other Subcontractors to allow the performance of its and their respective obligations to occur concurrently. Employer shall inform the Other Subcontractors of the clear demarcation of Contractor's scope of work so as to ensure non-interference in such work and operations by Employer's Other Subcontractors.

13. **Reserved Rights**

13.1 Plant

To the extent Contractor believes, in its reasonable discretion, that it is necessary to enhance the overall performance or safety of the Plant, Contractor may propose to Employer changes and improvements to the Plant (including the software included with respect thereto) and implement such changes or improvements proposed after obtaining the prior written consent of the Employer; provided that such changes and/or improvements shall not (i) be in conflict with the Performance Standards; (ii) adversely impact the technical performance of the Plant or the safety of the Plant; (iii) adversely impact the Availability Warranty in Annexure 2 [Functional Guarantees] (iv) increase the cost of operating the Plant; (v) place the Employer in breach of the technical requirements of the Power Purchase Contract; (vi) impair or vitiate any obligations of the Contractor under the contract; (vii) adversely affect the Supply Contract Warranties and the Works Contract Warranties; or (viii) result in non-compliance with the Type Certificate.

- 13.2 The Contractor shall only have the right to implement such changes or improvements if it has received the prior written consent of the Employer and such changes and improvements are carried out at no cost to the Employer and in accordance with Reserved Rights.

14. **CERTAIN NOTIFICATIONS BY CONTRACTOR**

- 14.1 Contractor shall, upon obtaining actual knowledge thereof, promptly give the Employer notice of:

- (i) any events or facts or observations that the Contractor believes could be reasonably likely:
 - (a) to have a material adverse effect on the operation of any of the Plant or the performance of the Employer's obligations under the contract; or
 - (b) to cause an immediate threat to the safe operation of the Plant (or any Plant therein) and/or the safety of Persons; provided that, in the case of this Clause, the Contractor shall provide immediate verbal notice of such event, fact or observation to the Employer with notice to follow within three (3) Business Days;
- (ii) any actual or proposed event that the Contractor believes would be reasonably likely to have a material adverse effect on the operation of any of the Plant or the performance of either Party's obligations under the contract;

- (iii) any (a) violation of Applicable Laws, or Permit, by the Contractor's agents, officers, directors, employees, representatives and Subcontractors, Employer or any Other Subcontractor; or (b) any notices of Liens (or claims of Liens) or investigations by Governmental Authorities related to the Plant;
- (iv) any actual or contemplated change in Law that Contractor believes would be reasonably likely to have a material adverse effect on the operation of any of the Plant or the performance of either Party's obligations under the contract.

14.2 If the Contractor does not comply with its obligations under Certain Notifications by Contractor, the Contractor shall, subject to Limitations of Remedies and Liability, indemnify the Employer for any loss the Employer may suffer as a consequence, including, without limitation, compensation pursuant to Employer's Obligations.

15. **ASSIGNMENT AND SUBCONTRACTING**

- 15.1 The Contractor shall not sublet, transfer or assign the contract or any part thereof without the prior written permission of Employer. The Contractor shall not subcontract any of the Services having a value of more than 30% of the Annual O&M Price of the concerned year, except upon the Employer's advance written approval of the subcontracting of such works. Such approval shall refer to the specific identity of the Subcontractor and to the scope and terms of the subcontract. In any event, the Contractor shall not subcontract all, or materially all of the Operation and Maintenance Services or the ultimate supervision of the performance of such services.
- 15.2 The Contractor agrees and acknowledges that any review, by approval of, or failure to approve, or rejection by the Employer as to any Subcontractor shall not relieve the Contractor of any of its obligations under the contract, and the Contractor shall be liable hereunder to the same extent as if any such Subcontract had not been entered into. The Contractor shall at all times ensure and cause the Subcontractors not to commit any act or omission which could release, void, impair or waive any guarantee or warranty on the Plant or any part thereof.

15.3 The Contractor shall supervise and direct the work of all Subcontractors and be fully responsible for the performance of the Subcontractors and to the methods, techniques, sequences and procedures of, and for coordinating the work of the Subcontractors and to the acts and omissions of all Subcontractors and their employees, directors, officers, advisors, agents and representatives, and those of their subcontractors ("Subcontractors' Parties). With regard to any Subcontract and Subcontractor's Parties, in particular, Contractor shall ensure that all wages, labor, health and safety and social related obligations are duly performed and timely discharged in accordance with Applicable Laws. It is agreed that if the responsibility of any such payments is transferred to the Employer pursuant to Applicable Law, the Employer shall have the right to adjust all such payments against the dues to the Contractor under the contract or otherwise recover the same from the Contractor under any other Contract. It shall be at Contractor's sole responsibility to ensure the payment and discharge of all its obligations with regard to the Subcontracts and shall indemnify the Employer and any Employer Indemnified Parties for any losses incurred by such parties in relation to the Subcontracts or to Subcontractor's Parties.

16. **Inspection and Testing**

16.1 The Contractor must provide the Employer, independent engineer, Grid Operator, Grid Administrator, and any other Contractor or Contractors employed by the Employer and their respective nominees, or other inspectors where required under the Applicable Law, the Permits, the Finance Documents and/or the Grid documents (collectively hereinafter referred to as the "**Project Parties**"), with access at any time to any place where the Services are being performed in order to inspect the progress and the manner of the Services, provided that the Employer (or its designated representatives) gives the Contractor twenty four (24) hours prior written notice.

16.2 The Project Parties and their respective nominees will have the right to examine and have access to documents relating to the Services.

16.3 The Contractor must carry out all tests and/or inspections of the Plant or Spare Parts in a lawful, professional, timely, safe and environmentally responsible manner as may be necessary to ensure the safe, reliable, efficient, and optimal operation of the Plant and in accordance with the Performance Standards, Applicable Laws and Good Solar Industry Practice. All these tests and inspections are to be carried out at the Contractor's expense, as part of Services.

16.4 The Project Parties and their respective nominees are entitled to attend any test and/or inspection.

- 16.5 Whenever the Contractor is ready to carry out any test and/or inspection, the Contractor must give at least ten (10) days' advance notice to Employer of such test and/or inspection and of the place and time. The Contractor shall make its best efforts to obtain from any relevant third party or manufacturer any necessary permission or consent to enable the Project Parties to attend the test and/or inspection.
- 16.6 The Contractor must provide the Employer with a report of the results of such test and/or inspection within five (5) days after the completion of that test or inspection in question.
- 16.7 If the Employer and/or any of the Project Parties fail to attend the test and/or inspection, or if it is agreed between the Parties that the Employer and/or any of the Project Parties will not attend, then the Contractor may proceed with the test and/or inspection in the absence of the Employer's and/or any of the Project Parties' inspector and provide the Employer with a report in the approved form of the results.
- 16.8 If any Spare Parts or the Plant fails to pass any test and/or inspection, the Contractor must either rectify or replace those Spare Parts or repair the Plant and promptly repeat the test and/or inspection upon giving notice.
- 16.9 The Contractor agrees that neither the performance of a test and/or inspection of Spare Parts or the Plant, nor the attendance by the Employer's and/or any of the Parties' inspector nor the issue of any test report will release the Contractor from any of its obligations under the contract.

16.10 Inspection during the Term and at the End of the Term:

During the Term, the Plant may be submitted to a general inspection performed by a Contractor selected by Employer:

16.10.1. Inspection during the Term

From time to time during the Term, but not more than once every year (being specified that any additional tests and inspections instructed by the Employer under this Clause will be for the Employer's account unless the tests or inspections were necessary as a result of the failure of the Contractor to fulfil its obligations under the contract);

16.10.2. End of Contract inspection: six (6) to twelve (12) months before the end of the Term, at the convenience of the Employer.

Subject to the Employer's reasonable advance notice as to the date of such inspection, Contractor is required to attend and assist the Employer and the designated inspector in performing such tests, without additional cost.

16.10.3. The final report shall be sent to the Contractor by the Employer and if any defect or damage found, same shall be rectified/replaced.

16.10.4. Without relieving Contractor from its obligations and without limiting Employer's ability to reasonably pursue the reliefs available to it, if applicable:

- (i) Contractor shall, promptly following receipt of the report, submit to the Employer (a) a recovery plan to remedy all breaches, defects and malfunctions detected in the report for which the Contractor is liable and shall perform such remedial actions without delay, and (b) provide detailed measures to be put in place to prevent such defaults from recurring;
- (ii) if the Contractor fails to timely complete all remedial actions before the end of the Term, the Employer shall be entitled, at Contractor's cost and risk, to employ a Replacement Contractor to perform the works.

16.11 Employer Site Visit

16.11.1. If Employer decides to visit the Plant, Contractor shall provide personnel on the Site for mutual inspection with no additional cost to Employer. If the Contractor is reasonably unable to attend such visit for unexpected reasons and/or safety reasons, Contractor shall immediately inform the Employer. As the case may be, the Contractor shall reschedule a new visit within the next seven (7) days. Rescheduling of the visits thereof shall no occur more than once per year the Employer shall adhere to the HSE practices of the Contractor.

16.11.2. If, upon request of the Employer made in accordance with Employer Site Visit, the Contractor does not provide dedicated personnel for such visits, subject to the aforementioned rescheduling allowance, any downtime of Plant Equipment(s) to perform the inspections thereof shall be considered as unavailable for the purpose of availability calculation described in Annexure 2 [Functional Guarantees] [(however never exceeding eight (8) hours per given visit)]. Notwithstanding the foregoing, Employer may request that Contractor provide personnel on the Site for additional inspections as an Additional Service.

- 16.11.3. If, upon request of the Employer made in accordance with Inspection and Testing, for inspection of the Plant, the Contractor provides access to have services in the Plant Equipment examined available for inspection and Employer does not carry out such inspection, then any downtime of Plant Equipment(s) to perform the inspections thereof shall be considered as available for the purpose of availability calculation described in Annexure 2 [Functional Guarantees]

17. HAZARDOUS SUBSTANCES AND HAZARDOUS SITE CONDITIONS

17.1 Contractor shall not, nor shall it permit any other Person to bring any Hazardous Substances on the Site, other than Hazardous Substances to be used by Contractor or any Subcontractor in a manner that:

- (i) does not violate any Applicable Laws, or Permits; and
- (ii) is consistent in quantity and with Good Solar Industry Practices for operating and maintaining solar energy conversion plants, such as motor fuels, solvents and lubricants (collectively, "**Permissible Materials**").

17.2 Contractor shall bear all responsibility and liability for:

- (i) any Hazardous Substances that are not Permissible Materials belonging to the Contractor or present on site; or
- (ii) the handling of, or failure to handle, Permissible Materials in violation of Applicable Laws or otherwise in any manner that constitutes negligence or willful misconduct by Contractor or any Subcontractor.

17.3 Contractor shall use Hazardous Substances in performance of the Services in accordance with the Performance Standards, Applicable Laws and Good Solar Industry Practices and shall not:

- (i) utilize, or permit or cause any Subcontractor to utilize, on the Site such Hazardous Substances as are prohibited under Applicable Law from being used in India; or
- (ii) import or use at the Site such Hazardous Substances as are prohibited under Applicable Law.

17.4 Contractor shall maintain a regularly updated log of all material safety data sheets for all hazardous substances used in connection with performance of the Services at or near the Site, which shall be available for Employer to review upon reasonable request. Contractor shall maintain an accurate record and current inventory of all hazardous substances used in performance of the Services at or near the Site, which record shall identify quantities, location of storage, use and final disposition of such hazardous substances.

17.5 Contractor shall arrange and agree for the disposal, transportation, reporting and certification (including provision of waste disposal vouchers and other certificates as required by Applicable Law or Permits) of Hazardous Substances, including waste disposal vouchers, brought onto and released at the Site by Contractor or its Sub Contractors, which are expected to include but not be limited to used oil, grease and ethylene glycol, to the extent required by Laws, in each case, by licensed, insured, competent and professional Contractors in a safe manner and in accordance with Laws. As between the Parties, Contractor shall be solely liable for any response, removal, investigation, clean-up or other remedial action required by any Laws related to any Contractor,

17.6 In the event Contractor encounters any Hazardous Substance or other hazardous conditions at the Site that are inconsistent with the Performance Standard or would reasonably be expected to impact the performance of Contractor's obligations hereunder, Contractor shall promptly report the condition to Employer. In such event, Contractor shall stop work and remove, or take other actions necessary to remedy the hazards associated with, any Contractor Hazardous Substances such that Contractor can resume work.

17.7 The Contractor shall indemnify and hold harmless the Employer against any fine, penalty or third-party Claim incurred as a result of non-compliance by the Contractor with the terms of the contract, Applicable Laws, Good Solar Industry Practice and more specifically, with its obligations under Hazardous Substances and Hazardous Site Conditions.

18. EMPLOYER'S OBLIGATIONS

During the Term, Employer shall perform the following obligations:

18.1 Access

18.1.1. On and from the Commencement Date, Employer shall provide the Contractor (and its Subcontractors) full, free and safe Access to the Plant for the purpose of enabling Contractor to fulfil its obligations under the contract.

Notwithstanding the foregoing, the Contractor shall be required to perform any works (including obtaining permits for such works) related to the Access to the Site required for the delivery of any Spare Parts, if so requested by the Employer in writing, on the Time to time Basis.

18.1.2. The Employer shall give to the Contractor and the Contractor's personnel unrestricted Access to the Site to enable Contractor and the Contractor's personnel to carry out all elements of the Services at any time from the Commencement Date until the end of the Term. Such Access shall include the provision by the Employer of:

- (i) such keys or access codes as may be required by the Contractor to gain unhindered access to the Site (as the case may be);
- (ii) Access to the access roads to and on the Site If there is any deviation, and such deviations are accepted by the transport contractor, then such deviations shall be accepted by the Contractor.

Notwithstanding anything else contained in the contract all Access to the Site and Plant is subject to the applicable site safety, security and environmental requirements and Applicable Law (and the Contractor should comply with the same). The Employer will have the right to limit Access or expel any Person off the Site in case of them not fulfilling the Emergency plan of the Site, the Emergency plan of the Plant Facility.

18.2 Employer's Permits

Contractor, on behalf of the Employer, shall obtain and maintain all Permits and any Permits required by Applicable Law to be obtained in the name of the Employer in order to (i) perform Employer's obligations under the contract and (ii) enable Contractor to lawfully access the Site at the point of entry to the Site and the Plant].

19. **SITE REGULATIONS**

Employer shall (directly or through a Subcontractor, advisor or agent) provide the Site Regulations and revisions thereof from time to time, and shall require the Other Subcontractors and their respective agents and employees to, (i) comply with the Site Regulations; and (ii) take all necessary precautions (as required by Applicable Law or otherwise) for the health and safety of all Persons (including Contractor's personnel) at the Site.

20. CERTAIN NOTIFICATIONS BY EMPLOYER

20.1 Employer shall, upon obtaining actual knowledge thereof, promptly give the Contractor, as soon as practicable, notice of:

20.1.1. any events or facts or observations that the Employer believes has determined that would:

- (i) have a material adverse effect on the operation of any of the Plant or the performance of the Contractor's obligations under the contract; or
- (ii) to cause an immediate threat to the safe operation of the Project (or any Plant therein) and/or the safety of Persons; provided that, in the case of this current Sub-Clause, the Employer shall provide as soon as possible verbal notice of such event, fact or observation to the other;

20.1.2. any (a) violation of Applicable Laws, including environmental Laws or the terms of any Permit, by Contractor or any Other Subcontractor or (ii) any notices of Liens (or claims of Liens) or investigations by Governmental Authorities related to the Project.

20.2 Failure to furnish notice pursuant to Certain Notifications by Employer shall not affect the Contractor's obligations to perform its obligations. Contractor.

21. EMPLOYER 'S OWNERSHIP OF ENERGY, EQUIPMENT, SPARES AND PROJECT BENEFITS

21.1 The Contractor acknowledges that ownership of the Energy or any benefits arising out of the operation of the Plant remains at all times, and in all circumstances with the Employer at all times and the Contractor has no legal or equitable title to or interest in the Energy or other benefit.

21.2 The ownership of all item supplied by the Contractor, including under Additional Services shall be transferred to the Employer at the end of the term of the contract:

(i) such items becoming a permanent part of the Plant against the mutually agreed payment by both the parties

21.3 The ownership of any item (not including Energy or benefits arising out of the operation of the Plant) supplied by the Contractor as part of the Services shall be transferred to the Employer upon such items becoming a permanent part of the Plant.

21.4 The Contractor agrees that any benefits, including any carbon credits, renewable energy certificates or similar royalty or credit that may arise as a result of having the Project undertaken belong to the Employer and the Contractor shall provide all reasonable assistance requested by the Employer in order to obtain such rights and benefits.

22. **PRICE AND PAYMENT**

22.1 Total Annual O&M Cost

Commencing on the Commencement Date and for the remainder of the Term, Employer shall, in consideration of the Contractor providing the Services and its prior receipt of an invoice with respect thereto, pay in accordance with Invoices and Payment to Contractor an annual O&M cost in INR in equal quarterly instalments at the end of every quarter for each year till 15 (Fifteen) years in the amounts set forth in and payable in accordance with Price Schedule No 5/SOR-5 [Schedule of Rates] of the bidding documents for the plant facilities. The yearly breakup of the Total O&M price shall be in line with the Price Schedule No 5/SOR-5.

Against the successful Operation and Maintenance of the entire Plant Facility payment will be released on quarterly basis at the end of every quarter for each year till 15 (Fifteen) years.

The O&M of the plant will commence from the date of Operational Acceptance of the plants.

The Contractor acknowledges that the Total Annual O&M cost forms the sole and exclusive consideration and reimbursement due to the Contractor for the performance of the services included under the Services and Spare Parts and that the Contractor shall not be entitled to any additional amount for their performance, for whatever reason, including, amount others due to increased costs, changes in applicable GST, customs or duties (including, without limitation those set forth in GST, Taxation and Import Duties below), and except as may be specifically provided in the contract.

22.2 Payment of amounts due to the Contractor:

Amount shall not be considered as due and payable and the period for the payment of any Price stipulated under the contract shall not commence until the Contractor has duly fulfilled and delivered all obligations and deliverables required from the Contractor until the date of submission of the invoice for the payment to the Employer with relation to such invoice and/or within the period for which the Price included in the invoice are due.

23. INVOICES AND PAYMENT

- 23.1 Contractor shall submit Goods & Service Tax (GST) compliant invoices to Employer for the amounts due under Total Annual O&M cost above and for any other amounts that may be due under the contract.
- 23.2 The Total Annual O&M Cost shall be invoiced by the Contractor quarterly against the completion of concerned quarter and each invoice may be submitted by Contractor no later than the day after the completion of the quarterly period in question and, subject to the terms of the contract, shall be paid by the Employer no later thirty (30) days from the date of submission of the invoice along with all other requisite documents (If so required). The Employer shall make payments by wire transfer to the bank account designated from time to time and owned by Contractor. The payment of any invoice shall be subject to the Contractor submitting to the Employer the Monthly Performance Reports.
- 23.3 Additional Services may, for purposes of this Invoices and Payment, be invoiced upon full and proper completion of each individual task and shall, subject to the terms of the contract be paid by the Employer within thirty (30) days from the date of submission of the invoice along with all other requisite documents (If so required).
- 23.4 VOID.
- 23.5 To the extent permitted by Applicable Laws, if the amount of an invoice is disputed by the Employer, the Employer shall be entitled to withhold payment of the disputed amount for the next invoice (or part thereof), until the dispute is resolved between the Parties under Law Dispute Resolution or otherwise. The Employer shall pay at the applicable time the undisputed amount of such invoice including any undisputed portion of the invoice item in dispute. Further, the Employer shall be entitled to withhold payment of any amount due to the Contractor, if, at the time, the Contractor is in breach of one or more of its material obligations in terms of the contract.

23.5.1. Subject to the provisions on the contract, the Contractor warrants that it has, and will be deemed to have, done everything that would be expected of a prudent, competent and experienced Contractor and in accordance with Good Solar Industry Practices in:

- (i) assessing all risks which it is assuming under the Contract; and
- (ii) ensuring that the **O&M Price** contain allowances to protect it against any of these risks eventuating,

and that it will not make a claim for an increase in the **O&M Price** if any of those risks eventuate.

23.5.2. Except for Liens arising out of a failure of the Employer to make any payment when due hereunder to Contractor or any other Person providing labour or services to the Project under Contract to the Employer, the Contractor acknowledges and agrees that it shall not file, claim or register any Liens and shall use its best efforts to prevent any Liens from being filed, claimed or registered by any Subcontractor or by any employee, or agent of the Contractor or Subcontractor, against the Services, Additional Services, the Plant as a whole or any part thereof, or any real or other property of the Employer, for any works done or any Services and/or Additional Services rendered under the Contract or any subcontract let by the Contractor and shall procure that all subcontracts contain undertakings to the like effect.

23.5.3. The Contractor shall indemnify the Employer against any loss, damage, cost or expense (including legal fees) of the Employer arising out of or in connection with any Lien being filed, claimed or registered as referred to Invoices and Payment.

23.5.4. The delay or failure of a party to pay any amounts due hereunder, or the withholding of any amounts which are claimed by a party to be due, shall not release the other Party from any of its obligations or liabilities under the contract.

24. SCADA, EMS

Contractor shall be required from time to time to update the SCADA and EMS software, as required for the ongoing adequate operation of the Plant Facility. Such updates shall also be provided to the Employer at no additional costs.

25. INSURANCE

25.1 Contractor 's insurance

The Contractor, at his own cost and expense, shall take out and maintain in full force and effect and shall cause its Subcontractors to take out and maintain in full force and effect, throughout the Term of the Contract and any extensions thereof, the following insurance policies from reputable insurers and shall provide the Employer with copies of the corresponding insurance certificates:

- a) Covering physical loss or damage to the all plant facilities at the Site, with an extended maintenance coverage for the Contractor's liability in respect of any loss or damage for the entire term of the contract.
- b) Workers compensation insurance, as required by the Applicable Law and Contracts made with employees.
- c) Group Medical Claim, Group Term Policy & Group Personal Accident Insurances covering the financial consequences cause by damage and loss arising from sickness, disease, injury or death of any person employed by the Contractor in respect of the services performed Automobile Public Liability insurance, as required by the Applicable Laws, for all vehicles and automotive equipment owned hired, rented, leased and non-owned by the Contractor and used in the performance of the Services.
- d) Comprehensive General third-party liability insurance including product and contractual liability covering the financial consequences of the liability arising out loss or damage caused to third parties or to the employer as consequence of the performance of the services.
- e) All other insurance like – transit insurance (Marine/ Cargo/ others as applicable), Construction All Risk, Erection All Risk, workmen compensation, fire, third party liability, insurance against Insurance against theft, fire, act of God, Contractor's Equipments, machinery breakdown policy, business interruption insurance, Property damage Insurance & Environmental risk insurance as required during the O&M period of the Plant shall be in the contractor's scope & shall borne by the Contractor.

The Service Provides shall ensure that under the aforementioned insurance policies, each of the insured has the ability to claim thereunder for a minimum period of three (3) months from the date of expiry of the insurance policies for any claims that arose prior to the expiry date.

The Employer shall be named as co-insured under all insurance policies taken out by the Contractor, except for the Third-Party Liability and Workers' Compensation Insurances, and the Contractor's Subcontractors shall be named as co-insureds under all insurance policies taken out by the Contractor, except for the Cargo, Workers' Compensation. All insurer's rights of subrogation against such co-insureds for losses or claims arising out of the performance of the Contract shall be waived under such policies.

Annual Status Report of Insurance Claims: The Contractor shall include the status of Insurance Claims made or required to be made during the year as part of the Annual Reporting Requirements.

25.2 Contractor's Insurance for the Plant Facility

The Contractor shall take out and maintain an insurance policy, seamlessly with CAR policy taken earlier during construction phase, preferably from same insurance company for the plant facility during the entire term of the contract

In the event of any incident or damage or loss that would be reasonably expected to result in an insurance claim, the Contractor shall:

- a) Notify without delay to the Employer
- b) Prepare and conduct all and any claims made under the policies effected by it, and all monies payable by any insurers shall be paid to the Contractor take all reasonable measures to mitigate the loss, its effects and to protect salvage.
- c) Collaborate with Employer and the insurer and provide them with all information and documents they may request.
- d) Arrange immediate reinstatement of the damage to the employer's satisfaction, without waiting for the settlement for the corresponding insurance claim.
- e) Claim in pursuant to the contract to the insurance agencies, if the claim is accepted or rejected or not accepted or partly accepted by the insurance agency then it will not limit the contractor obligation in any case and also if any losses on account of this shall be in the scope of contractor.

25.3 General Insurance Requirements

25.3.1 The Contractor shall, provide copies of the corresponding insurance certificates mentioned above.

25.3.2 If the Contractor fails to effect or maintain any insurance policy required hereunder, or fails to produce copy of the corresponding insurance certificates, the Employer may (but as no obligation), without prejudice to any other right or remedy available to it under the contract, procure the insurance for the relevant coverage and/or pay the premiums due. Such payments shall be recoverable and deducted from the payments to be made to the Contractor by the Employer under the Contract. In the event if Contractor does not pay the premium, then the Employer may pay the premium however in such case the obligations of Contractor to undertake the coverage shall continue as envisaged, irrespective of premium being paid by Employer. The Premium if paid by the Employer shall be recovered from the Annual O&M Fees payable by the Employer to the Contractor.

25.3.3 The Contractor shall comply with the conditions stipulated in each of the insurance policies to be affected under the Contract and shall not make any alteration to the terms of any policy subscribed by it so it deviates from the requirements herein.

25.3.4 The Contractor must promptly notify to the Employer any notification received from an insurance company regarding any actual alteration to one of their policies.

25.3.5 On occurrence of any loss covered by an insurance policy contemplated under *Insurance*, the Contractor shall, as soon as reasonably possible, notify to insurance companies for the policy subscribed by it. The Contractor shall also take any appropriate measure to mitigate the effects to the loss to the maximum extent possible. The Contractor shall assist any assessment mandated by the insurance companies.

25.3.6 The required coverages referred to and set forth in this Article 33 (*Insurance*) shall in no way affect or limit the Contractor's liability with respect to its obligations under the Contract.

25.4 The Contractor shall also arrange suitable insurance to cover following during the O&M Period:

- a) **Machinery Breakdown**: Electrical & or machinery breakdown of any machinery or other equipment resulting in costly repairs or even replacement of the solar panel.
- b) **Business Interruption**: Cover for period of operational downtime i.e., covering the cash flow of the solar business as a result of an insured peril, for example fire or storm damage, machinery breakdown or equipment failure.

- c) **Property Damage**: The insurance should cover material damage due to external causes such as fire, theft, vandalism, sabotage, hail damage, snow load, lightning strike, overload, operational mistakes, clumsiness, negligence & theft.
- d) **Employers Liability**: Provides cover against the risk of accident from usual workplace risks such as working at height & manual handling during construction & O&M period..
- e) **Environmental Risk Insurance**: Environmental damage coverage indemnifies solar system owners of the risk of either environmental damage done by their development or pre-existing damage on the development site.

ANNEXURE 1:
Scope of Work for Operation and Maintenance

- i) The Contractor shall prepare the initial Annual Operating Plan for the Plant Facility and shall also indicate the proposed resources (manpower, material & machinery) that would be deployed for O&M.
- ii) The Contractor shall be responsible for the smooth day-to-day operation of the Plant Facility.
- iii) The Contractor shall provide necessary routine and preventive maintenance schedules of the plant for the Employer's approval and shall carry out all routine and preventive maintenance accordingly.
- iv) The Contractor shall perform periodic overhauls and preventive maintenance required for the Plant in accordance with the recommendations of equipment manufacturers and as per the O&M manuals.
- v) Contractor shall perform all break down maintenance and other maintenance in the Plant Facility. The Contractor shall be responsible for achieving the performance guarantee of the plant as indicated in the contract.
- vi) The Contractor shall operate and maintain fire protection system and safety equipment for the plant.
- vii) The Contractor shall do maintenance of Electricity system including overhead lines in the Plant Facility area up to the Point of Common Coupling (PCC) to the grid at the site. Necessary co-ordination shall be made by the Contractor with TANGEDCO/SLDC and other agencies as may be required during the Operation and Maintenance term for smooth operation of the plant.
- viii) Contractor shall work in coordination with the Employer or any Employer's designated party to optimize the Plant production.

- ix) The Contractor shall provide required spare plant Equipment, Spare Parts, tools and tackles, consumables required for comprehensive operation and maintenance of the plant facility. The Contractor shall make arrangement to procure required spare parts, or equipment/s as required, overhauling of parts, tools and equipment, required to operate and maintain the Plant in accordance with the recommendations of individual original equipment manufacturer at his own cost. Cost of imported Equipment & spare parts, if any, shall be included in the O&M quoted cost. The List of Consumables, Spare Parts, tools and equipment shall be finalised in consultation with the Employer or Employer's representative. List of recommended spare parts shall be submitted by the Contractor at the beginning of services, however the complete recommended spares will be in the scope of contractor only. In case any equipment or spares is not listed in the mandatory spares list but is required vitally for the operation of the plant, then the same shall be procured and provided by the contractor without any additional cost.
- x) It is the responsibility of the Service Provide to store the materials in appropriate stock yard or container at the site so as to ensure timely availability of the materials.
- xi) The Contractor shall employ only such personnel who are adequately qualified and experienced for operating and maintaining such power generating sets. The Contractor shall ensure that such personnel are on duty at the plant at all times, 24 (twenty-four) hours a day and 7 (seven) days a week commencing from the Date of Operational acceptance.
- xii) Contractor shall carry out all day-to-day operation and maintenance for the Plant Facility as set forth herein. Contractor shall perform the Work and supply all required spare parts in a prudent and efficient manner and in accordance with manufacturers and systems designers' specifications, the Annual Operating Plan for the Plant and all operation and maintenance manuals, all Indian applicable laws including environmental protection, pollution, sanitary, labour act, factory act, employment and safety laws, ("Government Rules") and Prudent Utility Practice. The contractor shall adhere to all labour laws which are applicable and as specified in the EPC contract document.
- xiii) Contractor shall arrange necessary security staff for watch and ward of the Plant Facility round the clock at his own cost, the details of which shall be furnished along with the bid.
- xiv) Contractor shall be responsible for:
- Maximizing plant capacity utilization,
 - Reducing plant downtime,

- Optimizing the useful life of the equipment of the power plant.
- xv) The Contractor shall maintain all accounting records regarding the facility in accordance with the generally acceptable accounting principles under the Laws of India.
- xvi) The Contractor shall maintain accurate and up-to-date operating logs, records and monthly reports regarding operation and maintenance of the Plant facility (Such records shall be distinctly recorded for Solar PV Plant, in order to have clear data for assessment of any individual component of the Plant Facility) which shall include details of power output, other operating data, repairs performed and status of equipment. All such records to be maintained for a minimum of 60 (sixty) months after the creation of such record or data and for any additional length of time required by regulatory agencies with jurisdiction over the Parties. Upon expiry of term, the Contractor shall hand over all such records to EMPLOYER. However, EMPLOYER shall have access to all such records at any time. Generation and O&M reports should be made available to EMPLOYER on daily and monthly basis in required formats as well as the Quarterly and Annual Performance Reports shall be provided. Contractor shall provide communications as well as daily, weekly, monthly, quarterly and annual reports to the employer in the desired format as per the Contract with the Employer or Employer's Engineer.
- xvii) The Contractor shall develop and implement plans and procedures including those for fire fighting, maintenance planning, procuring and inventory control of stores and spares, plan to meet emergencies, plant safety and security; and such other facilities and systems as may be necessary to commence Contractor's ongoing responsibilities.
- xviii) The Contractor shall provide copies of all necessary documents including the following :
- Operation and maintenance manuals shall be prepared and approval shall be accorded from Employer within three months from the date of Operational acceptance.
 - Failure Analysis/history/trouble shooting details of all the Equipment
 - Identification of Equipment needing preventive maintenance
 - List of Vendors indicating name and addresses during operation and maintenance with credentials
 - root cause analysis report for any major failure.
 - Record of consumables / spare parts

xix) The Contractor shall be responsible for conveying following details to the Employer on daily basis as well as on monthly basis (by the end of 5th day of each month) by fax/ e-mail giving the detail of plant performance during previous month.

- Power generated at all Solar PV Plant
- Power fed to the grid
- Internal power loss and internal consumption
- Power consumption for captive use (if any)
- Reactive power consumption
- Downtime of Plant Facilities including Solar PV Plant and other infrastructure of the Plant facility.

xx) The Contractor shall be responsible for liaising with statutory authorities and local authorities in order to ensure smooth operation of the Power Plant.

xxi) Contractor shall provide constant remote surveillance to the Plant Facility

xxii) Contractor shall provide updates and revisions to Reference Documents, as and when applicable.

xxiii) Shall implement software updates to control and monitoring systems including EMS/SCADA in order to meet the plant facility operating requirement in consonance with the grid operations and in compliance with the grid codes as applicable during the operation.

xxiv) Duly and timely provide the Employer (or parties designated by the Employer) with all notifications required under the Contract including in particular such notifications set forth in Certain Notifications by Contractor;

xxv) Contractor shall provide access to the Employer to all data for the Plant Facility from the EMS including the SCADA system.

xxvi) Contractor shall at all times allow and provide Employer all necessary information for the operation of EMS including the SCADA system (with no notification or approval of access being required unless specifically and otherwise agreed to by the Parties) full, free, unconditional, safe and complete access to the EMS including the SCADA system. Contractor shall monitor and operate the Plant in accordance with the contract and shall ensure smooth operation of the plant.

- xxvii) Provide the training to the Employer's personnel in relation to the operation of the complete plant facility. Training shall be provided to the employer within 190 days before end the contract.
- xxviii) Contractor shall provide the insurances prescribed in insurance. The Contractor shall, with [prior intimation of 5 Business Days] at regular business hours, allow persons duly authorized by the Employer including but not limited to the officials of the insurance company of the Employer, to inspect the Project and provide to such personnel, access to all information which is necessary for their inspection, and is reasonably requested by the Employer. All representatives of the Employer shall strictly adhere to the Applicable Laws and the Health, Safety and Environmental (HSE) practices of the Contractor as provided in the Reference Documents;
- xxix) Contractor shall provide for the watch and ward of the Plant at all times during the Term. The watch and ward deployment plan shall take care of comprehensive Project level security and the Contractor shall take necessary steps to prevent sabotage, theft, vandalism and malicious damage of the assets comprising the Plant, and shall also coordinate and liaison with law enforcement authorities. The Contractor shall take all possible measures to keep the plant operational and secure.
- xxx) Contractor shall Coordinate with SLDC and other related entities/departments/local Panchayats as required for proper operation of the Plant Facilities. Also coordinate with relevant agencies for monthly Joint Meter Readings, meter testing, and any other requirements such as any audit or inspection by the government agencies or authorities, financiers, any designated third-party agency etc. for the Project operations.
- xxxi) Contractor shall be responsible for appointing a Qualified Coordinating Agency at the Pooling Substation Level and shall be responsible for carrying out the forecasting and scheduling of the energy generation from the plant facility (In accordance with the Deviation Settlement Mechanism Regulations, as applicable). Scheduling given by the Contractor is such that no penalty is levied on the Employer due to any deviation of actual generation from scheduling beyond the allowed limit. If any penalty is imposed on the Employer due to such deviations beyond allowed limit the same shall be passed on to the Contractor and the recovery of the same will be done from the O&M Price payable to the Contractor.
- xxxii) Water requirement for module cleaning arrangement and the cost for the same shall be borne by Contractor. The Contractor shall arrange for water on it's own, by ensuring ESIA norms.

- xxxiii) Contractor shall be responsible to comply with all applicable National and International Standards as well as local statutory provisions related to Environmental Protection Regulations, Health and Safety requirement.
- xxxiv) Contractor will be responsible for coordinating with the OEMs for securing warrantee conditions and services from OEMs as per the warrantee of each equipment, as well also for the Project insurance claims.
- xxxv) Contractor shall carry out the performance monitoring for the Plant Facility on continuous basis and in case of any deviation, the Contractor shall perform the due diligence appropriately to find out the actual root cause of such deviation. Any test or inspection required such as thermal imaging, IV characteristics test etc. to analyse such deviation will be the responsibility of the Contractor. Thereafter the corrective action required to mitigate such deviation shall be undertaken by the Contractor without any additional cost.
- xxxvi) Contractor shall be responsible for maintenance of all each and every civil infrastructures parts like Building, cable trench, fencing, drain, plumbing system fire-fighting system, CCTV system, security arrangement, road, earthing, any foundations, anti-weeding, clearing bushes in the solar field etc., as per the direction of employer's Engineering In-charge.

ANNEXURE 2
Functional Guarantees

1. Annual CUF Guarantee

- A. In consideration for the payment of the O&M Price , from the Commencement Date until the end of the Term, the Contractor grants to the Employer the CUF Guarantee on the terms and conditions set forth in the contract.
- B. The Contractor guarantees the annual CUF committed herein over the O&M Period (“**Annual CUF Guarantee**”) from the date of Operational Acceptance. In the event the CUF is less than the Guaranteed CUF, the Contractor shall immediately, upon demand, indemnify the Employer, as liquidated damages and not as penalty, amounts equivalent to remuneration of the equivalent Energy, subject to a maximum of hundred (100%) percent of the Total Annual O&M Price.
- C. Capacity Utilization Factor (CUF) for Solar Plant shall be calculated as per the following formula.

$$CUF = \frac{E_{ac}}{8760 \times P_{ac} \times (1 - DF \times (N - 1)) \times RCF}$$

where,

Eac is the number of units recorded in the plant end ABT meter excluding auxiliary consumption, kWh

8760 refers to the number of hours in non-leap year. It shall be replaced by 8784 hours during leap year

Pac is the plant AC capacity, kW

DF is module degradation factor, 0.7% per year

N is the number of years of operation after operational acceptance of the plant

RCF is the Radiation Correction Factor:

$$RCF = \frac{\text{Measured Irradiation}}{\text{Reference Irradiation}}$$

Reference Irradiation for the site = Long Term Average Annual GHI (kWh/m²) at the site as per SolarGIS database.

The Measured Irradiation (GHI_{mes}) shall be recorded from the Pyranometer installed in horizontal plane at the site location (average in case of multiple pyranometers). The radiation data of the Pyranometer shall be compared with the Reference Irradiation mentioned above. The radiation data from the Plant Pyranometer shall be used for computation of CUF, except in case of any discrepancy (i.e. more than $\pm 10\%$ variation from the Reference Radiation, GHI_{ref}), in which case the radiation data from SolarGIS database for the said period will be used for computation of CUF. Missing data (GHI_{mes}) from the Plant Pyranometer shall be substituted by average of GHI measured for the same period in the past three (3) days. The plant Pyranometer has to be under CCTV coverage.

Note:

- i. CUF shall be calculated on annual basis from the date of operational acceptance of the plant till the end of O&M period.
- ii. Module degradation factor will not be considered for first year CUF calculation. It is the Contactor's responsibility to envisage and install extra DC capacity to accommodate any degradation during first year.
- iii. Grid outage hours shall be subtracted from total number of hours in a year. The Contractor shall submit grid outage certification from competent authority of STU/CTU.

D. Liquidated Damages for Shortfall in Annual CUF for Solar PV Plant

If the Contractor fails to achieve guaranteed annual CUF at the end of First Year, the Contractor shall pay compensation to the Employer (amount to be deducted from the Final Payment at the end of 1st year), an amount equal to the NPV of the estimated shortfall in cash flow resulting over the period of 25 years due to reduced Plant CUF, calculated at a tariff of Rs.8 per unit (kWh) and discount rate of 7.9%.

The Contractor may take corrective action during the ensuing year to demonstrate the guaranteed CUF at the end of the 2nd year. In such case, the part of the Final Payment withheld by the Employer on account of Liquidated Damages shall be released and the CUF shall remain unchanged from the tender specifications.

If the Contractor fails to demonstrate the guaranteed CUF at the end of 2nd Year as well, the CUF achieved at the end of First Year shall be fixed as the new Guaranteed CUF for the remaining period of this Contract.

Illustration:

Guaranteed Annual Energy (MWhs) after 1 Year (assuming RCF =1):

$$P_{ac} * 8760 * CUF_e * (1 - DF \times (N - 1))$$

$$= 5 * 8760 * 0.2 * (1 - 0.007 * (1 - 1)) = 8,760 \text{ MWh}$$

If Actual Generation during First Year = 8,500 MWh i.e. CUF = 19.41%

Estimated Shortfall in Cash Flows over 25 years:

Year	Expected Energy as per Guaranteed CUF (MUs), A	Estimated Energy Based on First Year Performance (MUs), B	Estimated Shortfall in Revenue in Rs. Lakhs (A-B) x 8 x 10, C
1	8.760	8.500	20.800
2	8.699	8.441	20.654
3	8.637	8.381	20.509
4	8.576	8.322	20.363
5	8.515	8.262	20.218
6	8.453	8.203	20.072
7	8.392	8.143	19.926
8	8.331	8.084	19.781
9	8.269	8.024	19.635
10	8.208	7.965	19.490
11	8.147	7.905	19.344
12	8.085	7.846	19.198
13	8.024	7.786	19.053
14	7.963	7.727	18.907
15	7.902	7.667	18.762
16	7.840	7.608	18.616
17	7.779	7.548	18.470
18	7.718	7.489	18.325
19	7.656	7.429	18.179
20	7.595	7.370	18.034
21	7.534	7.310	17.888
22	7.472	7.251	17.742
23	7.411	7.191	17.597
24	7.350	7.132	17.451
25	7.288	7.072	17.306

LD applicable = NPV of Column C calculated at Discount Rate of 7.9%

= ₹ 2,10,98,747.98 (to be deducted from the final payment)

- (i) In case the EPC Contractor takes corrective action and demonstrates guaranteed CUF at the end of 2nd Year i.e. :

LD Applicable = Shortfall in Generation in the First Year x Rs.8

$$= (8.76 - 8.5) \times 8 \times 10^6 = ₹ 20,80,000$$

The Balance Final Payment Amount shall be released to the EPC Contractor.

(ii) In case the EPC Contractor fails to demonstrate the guaranteed CUF at the end of 2nd Year, Annual CUF guarantee for the remaining period of the Contract shall be fixed as the CUF demonstrated at the end of First Year, as revised CUF. Liquidated Damages applicable in subsequent years, on account of shortfall in generation, shall be determined with reference to this revised CUF.

- E. In case the Project fails to generate any power continuously for 1 month any time during the O&M period, apart from the force majeure and grid outages as certified by competent authority from STU/ CTU, it shall be considered as “an event of default”. In the case of default the entire Contract Performance Security will be forfeited.
- F. Penalty during O&M period against breakdown of other Infrastructure of Plant Facilities that don 't affect the generation of power directly, such as but not limited to, civil infrastructure, water supply system/network, other Infrastructure developed by the Contractor as a Scope of Work for the Project (Section-VII: Scope of Works & Technical Specifications) shall be penalised @ Rs.1000/day, for non-compliance with PM Schedule (Initiation/Completion of Scheduled maintenance Activity as agreed under this Contract) beyond 48 hours. Cumulative value of such penalty shall be limited to 50% of yearly O&M cost. Cumulative value of such penalty shall be limited to 50% of yearly O&M cost.

For the purpose of this Clause, the PM shall be inclusive of, but not limited to, the following PM activities:

Item	Scope of Maintenance Activity	Periodicity
Environmental/Corrosive Protective Coatings	White-washing/Application/Re-application of Distemper, Epoxy coatings	Once in every 2 years under the O&M Contract period, in consultation with the Owner
Roads and Access paths	Repair and maintenance of all roads – Access, Internal and Periphery roads, walkways as well as fences, gates, cable-trenches and outdoor equipment platforms.	Once every year prior to Monsoon season, in Consultation with the Owner
Water Supply Network	Repair and Maintenance of Water Supply Network including piping network, valves, pumps etc.	Once Every Year in Consultation with the Owner.
Periphery Lighting	Repair and maintenance of Peripheral Lighting including replacement of non-functional lighting fixtures, Junction Boxes, Conduits etc.	Once every Six Months
Rodent Entry Points	Application/re-application of Anti-rodent protection measures like PUF filling, sealant etc. at Checker/Gland Plates, Cable Entry Points (in PCU/SMU, Switchgear Panels, Buildings, Enclosures)	Once every Six Months

All bolted/tightened structures	Tightening/fastening of bolts that are exposed to winds/vibrations like MMS members/foundation bolts	Once every Year before onset of Windy season, in consultation with the Owner.
Enclosures of Equipment requiring Temperature and Dust Controlled environment for Normal Operation	Application/re-application of insulation/Dust-Filters/Temperature-control equipment at Enclosures/Buildings housing PCU, Switchgear	Once every Year, consultation with the Owner.
Entire Plant Facility	Oversight management of the hazardous/toxic materials including its handling and disposal as per Government of India Rules and environmental and safety assessments by a qualified Specialist	Once every Year, in consultation with the Owner.

Note : *The Contractor shall ensure intimation and submission of requisite Reports to the owner at least 15 days prior to initiation of maintenance action for the activity. The*

G. Void

H. The Penalty specified on account of delays, as specified in Liquidated Damages and Penalty specified on account of deviations in Functional Guarantees as above shall be assessed independent of each other. Above mentioned Penalties specified under this clause of SCC are independent of each other.

Recovery of Compensation

The above compensations shall be deducted from Contract Performance Security (CPS) submitted by the Contractor.

Scheduling and Forecasting:

1. The Contractor shall be responsible for appointing a Qualified Coordinating Agency if required by concerned authorities at the Pooling Substation Level for scheduling and forecasting activity. Also, the contractor shall be responsible for carrying out the forecasting and scheduling of the energy generation from the plant facility (In accordance with the Deviation Settlement Mechanism Regulations, as applicable). Scheduling given by the Contractors is such that no penalty is levied on the Employer due to any deviation of actual generation from scheduling beyond the allowed limit. If any penalty arises due to DSM after adjusting the payable and receivable imposed on the Employer due to such deviations beyond allowed limit, the same has to be paid by the contractor separately. If the contractor fails to pay such penalty, then it shall be recovered from the contractor's payment to be done by Employer.

2. The deviation charges, as per applicable regulations, for the difference in units between scheduled and actual generation shall be recovered from the contractor on following basis.

2.1 In case of any deviation due to forecasting and scheduling error, Contractor shall bear the cost/Penalty.

2.2 In case of localized thunderstorm/sand storm, the Employer shall bear the deviation charges till the time period before which the revision of scheduling is not allowed, as per applicable regulation.

2.3 In case if there is a component/Machine/Inverter failure, the Employer shall bear the deviation charges on account of such failure till the time period block before which the revision of scheduling is not allowed, affected as per applicable regulation. The contractor shall bear the deviation charges due to such failure beyond such time period.

Appendices

1. Reference Documents

Auto SS

22KV bay

Transmission line route

UG/OH line



Solar plant site

UG Transmission line

OH Transmission line

Camp II

Tsunami Colony

Port POS

Auto SS

Railway crossing

Rly crossing near Check Post II

Port
Point of supply

Tsunami
colony

Railway crossing

Harbour Highway Extension

Google Earth

50 m



SOIL TESTING REPORT

SOIL INVESTIGATION WORKS AND LABORATORY TESTING SERVICES
FOR THE CONSTRUCTION OF **SOLAR POWER PLANT** AT
V.O.CHIDAMBARANAR PORT TRUST, TUTICORIN.

REPORT No:131A / SI / GMC / 17 -18	DATE : 26.12.2017	REV : 0
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WORK ORDER NO: CIV- MTCMS- MNT- SUB- V1- 17/D 2799 DATED 19.12.2017

LOCATION : V.O.CHIDAMBARANAR PORT TRUST,
TUTICORIN.



SUBMITTED TO : **THE ASSISTANT EXECUTIVE ENGINEER, WS&PH,**
V.O.CHIDAMBARANAR PORT TRUST,
CIVIL ENGINEERING DEPARTMENT,
ADMINISTRATIVE OFFICE, TUTICORIN – 628 004.



PREPARED BY :  **GEOMATRIX CONSULTANCY**
(AN ISO 9001: 2015 CERTIFIED FIRM)
141A & 142, SVSK Towers,
Alagar Koil Road, Tallakulam, Madurai-625002,
Ph : 7598031360, 7708758588 (O), 7708758598 (Lab)
email: geomatrixconsultancy@gmail.com
web : www.geomatrixconsultancy.com

REPORT NO: 131A/ SI /GMC/ 17-18DATED:27.12.2017

To

THE ASSISTANT EXECUTIVE ENGINEER, WS&PH,
V.O.Chidambaranar Port Trust,
Civil Engineering Department,
Administrative office, Tuticorin – 628 004.

Respected Sir,

Sub: Submission Soil investigation Report – Reg

Work order No: CIV- MTCMS- MNT- SUB- V1- 17/D 2799 Dated on 19.12.2017

Name of work: Conducting Sub soil investigation works for the construction of
SOLAR POWER PLANT at V.O.Chidambaranur Port Trust, Tuticorin.

* * * * *

We appreciate the opportunity of service to you on this project and trust this reports meet your needs at this time. This report summarizes the result of our investigation and contains geotechnical recommendations for design and construction of this project.

Based on the result of our geotechnical investigation, we believe that the proposed project is feasible from a geotechnical point of concern, provided the recommendations in this report are incorporated in the design and implemented during earthwork and construction of the project.

If you have any queries regarding this report, please contact us. We look forward to being of further assistance as construction begins.

Respectfully submitted

CONTENTS:

1. Introduction
2. Scope of work
3. Location & Description of Structure
4. Soil Investigation
 - 4.1. Field sampling
 - 4.2. Method of investigation
 - 4.2.1 Exploratory Bore Hole
 - 4.2.2 Standard Penetration test
 - 4.2.3 Sampling in Bore Holes
5. Description of Ground Water Table
6. Laboratory Tests
7. Discussion on soil profile
8. Recommendations for foundation:
 - 8.1: Pile Foundation
 - 8.2: Open Foundation (Isolated Column Footing)
9. **FIGURES** : Fig 1 - Plan showing the location of borehole.
Fig 2A, 2B & 2C - Soil profile at borehole locations 1, 2 & 3
10. **TABLES** :1A ,1B & 1C - Summary of Lab Test Results



11. **ANNEXURES :**
- A. Sample Format for Nature Moisture Content Test
 - B. Sample Format for Specific Gravity Test
 - C. Sample Format for Sieve Analysis Test
 - D. Sample Format for Liquid & Plastic limit Test
 - E. Sample Format for Direct shear Test
 - F. Sample Format for Density Test
 - G. Sample Format for UCC Test
 - H. Sample Format for Free Swell Index Test
 - I. Sample Format for Chemical Analysis Test

12. **CALCULATION:** 1 to 8: Model Pile carrying capacity & SBC calculations



REPORT ON SUB-SOIL INVESTIGATION

1. INTRODUCTION:

THE ASSISTANT EXECUTIVE ENGINEER WS&PH, V.O.Chidambaranar Port Trust, Civil Engineering Department, Administrative Office, Tuticorin has proposed to construct a **SOLAR POWER PLANT** at V.O.Chidambaranar Port Trust, Tuticorin. In order to get adequate data required for designing the foundations, he has proposed to conduct the sub-soil investigation to determine the foundation design parameters vide **WORK ORDER: CIV- MTCMS- MNT- SUB- V1- 17/D 2799 Dated on 19.12.2017**

M/S.GEOMATRIX CONSULTANCY, Madurai, were entrusted with the work of conducting Sub-soil investigation, laboratory testing and preparing report with SBC Calculations and test results.

2. SCOPE OF WORK:

The Scope of work includes the following:

- Making **Three** borehole of 150 mm dia using rotary driller to a depth of **10 m** or up to 1.00m core drilling in hard rock which ever is met earlier.
- Conducting Standard penetration test at every **1.00 m /1.50m depth** intervals or change of soil strata and collecting disturbed soil samples.
- Conducting various laboratory tests on collected samples.
- Submitting recommendation for type and depth of foundation.
- Submitting report with SBC and settlement Calculations & laboratory test results in **three** hard copies.

3. LOCATION & DESCRIPTION OF STRUCTURE:

The proposed construction of **SOLAR POWER PLANT** in V.O.Chidambaranar Port Trust, Tuticorin.



GEOMATRIX CONSULTANCY
(An ISO 9001 : 2015 Certified Firm)
Madurai ,Ph :75980 31360

4. SOIL INVESTIGATION:

The details of field investigation, tests carried out in the field & laboratory are presented as follows

4.1 FIELD SAMPLING:

Three boreholes of 150 mm dia were made using Rotary drilling machine in this site on **20.12.2017 & 21.12.2017**. Three boreholes were advanced to a depth of 10.00 m below the existing ground level. SPT's were conducted at every 1.0 m/1.50 m depth intervals and the disturbed and undisturbed samples were collected for identification and testing.

4.2 METHOD OF INVESTIGATION:

4.2.1 EXPLORATORY BORE HOLE:

Exploratory borehole was advanced using rotary washing method so that minimum disturbance is attributed to the soil below the boring depth. Borehole was always kept filled with drilling mud to prevent any negative hydrostatic pressure within the borehole. Boring through the soil was performed using TC bit & diamond drill bit with side jets for drilling mud. Standard penetration tests, disturbed sampling, field identification of soil & rock samples, etc., was carried out in these bore holes.

4.2.2 STANDARD PENETRATION TEST:

SPT was conducted at different depth in the borehole. SPT split spoon sampler of standard size was driven into the soil from borehole bottom using 63.5kg hammer falling from 75cm height. Blow counts for the penetration of every 15cm were recorded and the **N** is reported as the blow counts for 30cm penetration of the sampler leaving the first 15cm penetration as seating drive. SPT was conducted at a depth interval of 1.0m below the ground level.

4.2.3 SAMPLING IN BORE HOLES:

Soil collected in the SPT sampler is preserved in polythene covers and transported to laboratory. One more polythene cover was provided to prevent the loss of moisture during the transit period. Rock samples also collected using double tubes core Barrel and preserving in wooden core boxes and transported to laboratory to conduct various tests.



5. DESCRIPTION OF GROUND WATER TABLE:

Ground water table was encountered at **1.20 - 1.27 m** respectively during investigation.

6. LABORATORY TESTS:

The collected soil sample was tested in **ISO 9001: 2015** Quality control Certified Laboratory as per relevant procedure in IS codes. The laboratory-testing scheme is so designed to obtain the design parameters for the foundations. The following parameters are evaluated:

- **Natural Moisture Content:** This test is conducted in all disturbed samples to find the water content in the soil samples as per **IS 2720 (Part 2) : 1973**
- **Specific Gravity:** This test is conducted in all disturbed soil samples to find Specific gravity of oil as per **IS 2720 (Part 3) : 1980**
- **Sieve Analysis:** These test conducted to identify and classify the samples as per **IS 2720 (Part 4) : 1985**
- **Liquid Limit:** This test conducted in fine-grained soils to find the liquid Limit of the soil as per **IS 2720 (Part 5) : 1985**
- **Plastic Limit:** This test conducted in fine-grained soil to find plastic limit of the soil as per **IS 2720 (Part 5) : 1985**
- **Direct Shear Test:** This test conducted in coarse-grained soil to find the angle of shearing resistance of the soil as per **IS 2720 (Part 13) : 1986**
- **Unconfined Compression Test:** This test conducted in fine-grained soil to find Cohesion of the soil as per **IS 2720 (Part 10) : 1995**

All the test results are presented in **Table 1A, 1B & 1C.**



7. DISCUSSION ON SOIL PROFILE:

Based on the field and Lab test results, it's concluded that,

In **BH 1**, the sub soil profile consists of Brown coloured **Sand mixed with Clay** (0 – 8.50 m), followed by Brown coloured **Sand** (8.50 – 10.00 m).

In **BH 2**, the sub soil profile consists of Brown coloured **Sand mixed with Clay** (0 – 2.00 m), Brown coloured **Sand** (2.00 – 3.00 m), Brown coloured **Sand mixed with Clay** (3.00 - 4.00 m), Brown coloured **Sand** (4.00 - 7.00 m), Gray coloured **Sand mixed with Clay** (7.00 - 8.05 m), followed by **Soft Disintegrated Rock** (8.05 m - 10.00 m)

In **BH 3**, the sub soil profile consists of Brown coloured **Sand mixed with Clay** (0 – 1.00 m), Brown coloured **Sand** (1.00 – 5.50 m), Gray coloured **Clay mixed with Sand** (5.50 - 8.75 m), followed by **Soft Disintegrated Rock** (8.75 m - 10.00 m)

The detailed Layer formations are presented in **Table 1A, 1B & 1C** and also in **Fig 2A,2B & 2C**.

8. RECOMMENDATIONS FOR FOUNDATION:

For the convenient of design of foundation, we herewith submit various options and their capacity as follows.

8.1: PILE FOUNDATION: The summary of Pile Carrying Capacity calculations are presented as follows. Necessary calculation sheets are presented in **Calculation 1-5**. Assume the depth of pile cap as **0.50 m** from the existing ground level.

Dia of Pile - 0.30m										
BH NO	Length of Pile 1.00m		Length of Pile 1.50m		Length of Pile 2.00m		Length of Pile 2.50m		Length of Pile 3.00 m	
	Safe Compress ion capacity in KN	Safe Pullout capacity in KN	Safe Compress ion capacity in KN	Safe Pullout capacity in KN	Safe Compress ion capacity in KN	Safe Pullout capacity in KN	Safe Compress ion capacity in KN	Safe Pullout capacity in KN	Safe Compress ion capacity in KN	Safe Pullout capacity in KN
1	43.86	0.69	49.01	1.61	49.97	2.56	51.53	4.00	52.96	5.44
2	48.42	0.71	49.07	1.67	50.04	2.63	52.22	4.08	53.67	5.52
3	43.86	0.69	44.78	1.61	45.69	2.53	51.12	3.90	52.55	5.34
Recommended Capacity in KN	43.86	0.69	44.78	1.61	45.69	2.53	51.12	3.90	52.55	5.34



8.2: OPEN FOUNDATION (ISOLATED COLUMN FOOTING) :

The summary of Safe Bearing Capacity calculations are presented as follows.
Model calculation sheets are presented in **Calculation 6-8**

BH No	Safe Bearing Capacity in KN/ m ²				
	1.00 m depth	1.50 m depth	2.00 m depth	2.50 m depth	3.00 m depth
1	35.02	48.45	69.70	87.07	210.83
2	38.96	53.89	70.34	87.89	213.29
3	35.02	48.45	62.97	78.66	209.6
Recommended SBC in kN / m ²	35	48	62	78	209

Station: Madurai

Date: 27.12.2017



LOCATION MAP

LOCATION :

V.O.CHIDAMBARANAR PORT TRUST,
TUTICORIN.

GPS COORDINATES

BH - 1 : N 08° 45' 04.04", E 78° 10' 58.98"

BH - 2 : N 08° 45' 01.15", E 78° 10' 47.53" &

BH - 3 : N 08° 44' 58.30", E 78° 10' 36.40"



NOT TO SCALE

SIX LANE ROAD

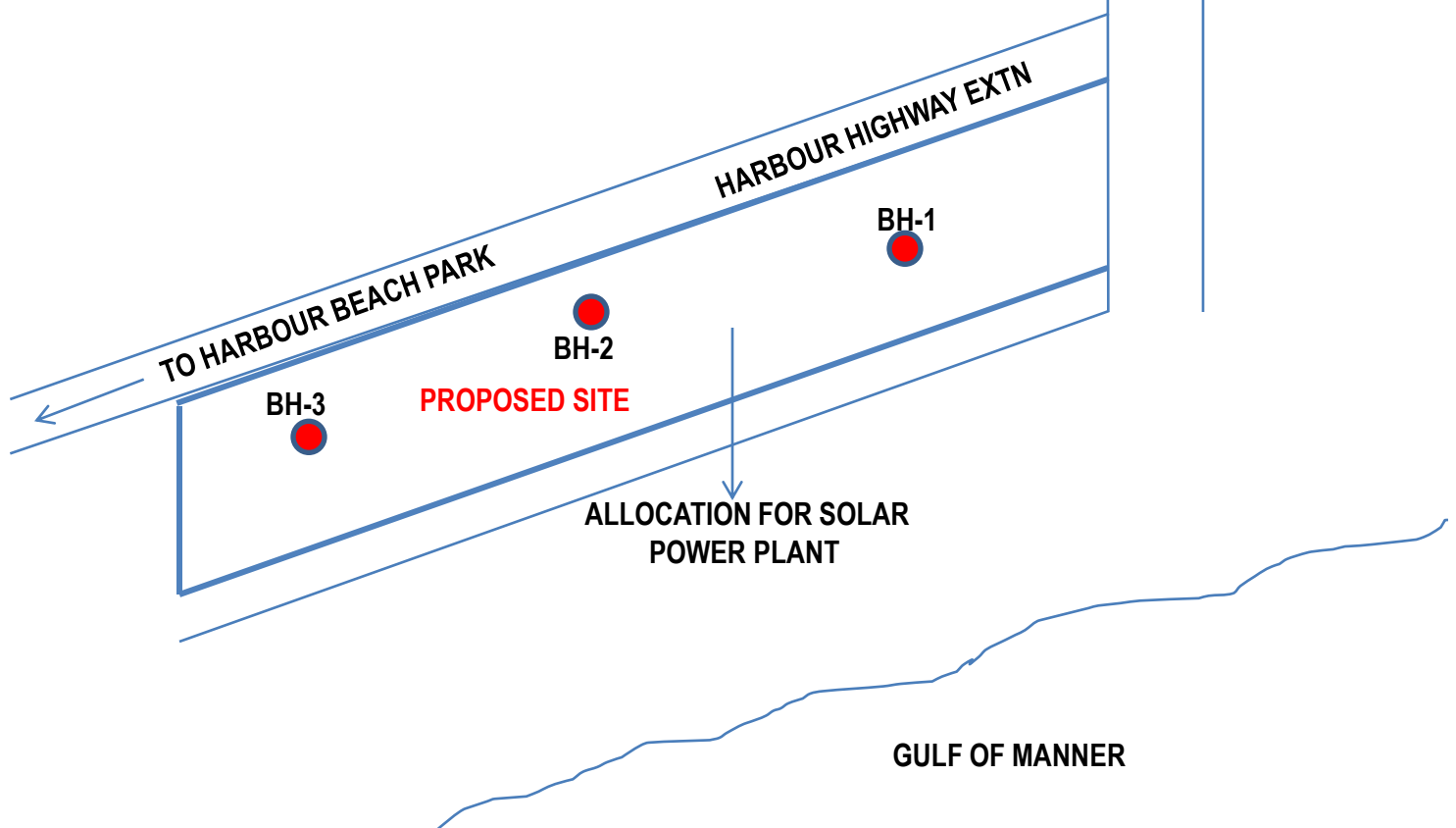


Fig 1 - PLAN SHOWING THE LOCATION OF BORE HOLES

LEGEND :

 — BORE HOLE LOCATION

PREPARED BY



GEOMATRIX CONSULTANCY

(An ISO 9001 :2015 Certified Firm)

141A & 142, SVSK Towers, Alagar Koil
Road, Tallakulam, Madurai-625002,

TITLE OF PROJECT


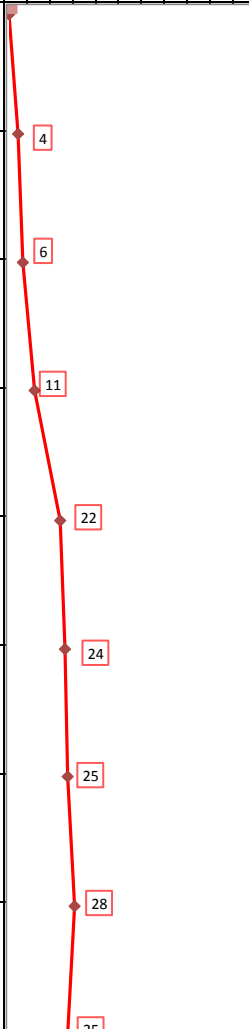
CONSTRUCTION OF **SOLAR POWER PLANT** AT
V.O.CHIDAMBARANAR PORT TRUST, TUTICORIN.



GEOMATRIX CONSULTANCY
Geo-Tech Consultants & Engineers

Name of Project : Sub Soil Investigation for the Construction of **SOLAR POWER PLANT** at V.O.Chidambaranar Port Trust, Tuticorin.

Report No	131A / 17 - 18 Dt : 26.12.2017		Dia of Boring	150 mm
Bore Hole No.	1		Total depth	10.00 m
Type of Boring	Rotary		Depth of Water Table	1.20 m
Started on	20.12.2017		Co - ordinates	N 08° 45' 04.04"
Ended on	20.12.2017			E 78° 10' 58.98"

Depth from ground level	Soil Profiles	Description of Soil (Visual Identification)	Depth (m)	Type	15	30	45	N	Graphical Representation of SPT (N value)											Type of Samples	
									0	10	20	30	40	50	60	70	80	90	100		
-1.00 m		Brown coloured Sand mixed with Clay	1.00	SPT	1	2	2	4													DS
-2.00 m			2.00	SPT	2	2	4	6													DS
-3.00 m			3.00	SPT	3	5	6	11													DS
-4.00 m			4.00	SPT	8	10	12	22													DS
-5.50 m			5.50	SPT	8	11	13	24													DS
-7.00 m			7.00	SPT	10	9	16	25													DS
-8.50 m			8.50	SPT	12	11	17	28													DS
-10.00 m		Brown coloured Sand	10.00	SPT	12	10	15	25													DS

Bore Hole is Terminated at a depth of 10.00 m Below G.L

DS - Disturbed soil sample

WS - Washing Sample

CR = Core Recovery

RQD = Rock Quality Designation

Fig 2A. Soil Profile at Bore Hole - 1 Location



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Name of Project : Sub Soil Investigation for the Construction of **SOLAR POWER PLANT** at V.O.Chidambaranar Port Trust, Tuticorin.

Report No		131A / 17 - 18 Dt : 26.12.2017						Dia of Boring		150 mm										
Bore Hole No.		2						Total depth		10.00 m										
Type of Boring		Rotary						Depth of Water Table		1.24 m										
Started on		20.12.2017						Co - ordinates		N 08° 45' 01.15"										
Ended on		20.12.2017								E 78° 10' 47.53"										
Depth from ground level	Soil Profiles	Description of Soil (Visual Identification)	Depth (m)	Type	15	30	45	N	Graphical Representation of SPT (N value)											Type of Samples
									0	10	20	30	40	50	60	70	80	90	100	
-1.00 m		Brown coloured Sand mixed with Clay	1.00	SPT	2	3	3	6												DS
-2.00 m			2.00	SPT	2	5	4	9												DS
-3.00 m		Brown coloured Sand	3.00	SPT	5	7	9	16												DS
-4.00 m		Brown coloured Sand mixed with Clay	4.00	SPT	7	12	12	24												DS
-5.50 m		Brown coloured Sand	5.50	SPT	9	11	12	23												DS
-7.00 m			7.00	SPT	1	1	2	3												DS
-8.05 m		Gray coloured Sand mixed with Clay	8.05	SPT	13cm for 50 blows			>100												WS
-8.50 m		SOFT DISINTEGRATED ROCK (CR = 0 %& RQD = 0)	8.50																	
-10.00 m			10.00	SPT	2cm for 50 blows			>100												WS

Bore Hole is Terminated at a depth of 10.00 m Below G.L

DS - Disturbed soil sample

WS - Washing Sample

CR = Core Recovery

RQD = Rock Quality Designation

Fig 2B. Soil Profile at Bore Hole - 2 Location



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Name of Project : Sub Soil Investigation for the Construction of **SOLAR POWER PLANT** at V.O.Chidambaranar Port Trust, Tuticorin.

Report No		131A / 17 - 18 Dt : 26.12.2017						Dia of Boring		150 mm											
Bore Hole No.		3						Total depth		10.00 m											
Type of Boring		Rotary						Depth of Water Table		1.27 m											
Started on		21.12.2017						Co - ordinates		N 08° 44' 58.30"											
Ended on		21.12.2017								E 78° 10' 36.40"											
Depth from ground level	Soil Profiles	Description of Soil (Visual Identification)	Depth (m)	Type	15	30	45	N	Graphical Representation of SPT (N value)											Type of Samples	
									0	10	20	30	40	50	60	70	80	90	100		
-1.00 m		Brown coloured Sand mixed with Clay	1.00	SPT	1	2	3	5												DS	
-2.00 m		Brown coloured Sand	2.00	SPT	2	2	3	5												5	DS
-3.00 m			3.00	SPT	4	6	5	11												11	DS
-4.00 m			4.00	SPT	5	5	4	9												9	DS
-5.50 m			5.50	SPT	1	2	2	4												4	DS
-7.00 m		Gray coloured Clay mixed with Sand	7.00	SPT	2	1	2	3												DS	
-8.75 m			8.75	SPT	12cm for 50 blows			>100												WS	
-10.00 m		SOFT DISINTEGRATED ROCK (CR = 0 %& RQD = 0)	10.00	SPT	14cm for 50 blows			>100												WS	

Bore Hole is Terminated at a depth of 10.00 m Below G.L

DS - Disturbed soil sample

WS -Washing Sample

CR = Core Recovery

RQD = Rock Quality Designation

Fig 2C. Soil Profile at Bore Hole - 3 Location



Report No :131A / 2017-18 Dt :26.12.2017

TABLE: 1A

Name of Project : Sub Soil Investigation for the Construction of **SOLAR POWER PLANT** at V.O.Chidambaranar Port Trust, Tuticorin.

Depth of soil (m)		Soil Description	Type of sample collected	IS Classification	Grain Size Analysis (%)					NMC	Index Properties (%)			Free Swell Index (FSI) IN %	Swelling Pressure in KN/m ²	Bulk Density (KN/m ³) γ_w	Specific Gravity	Cohesion "C" in (Kg/cm ²)	Angle of friction (ϕ)
From	To				Gravel	Coarse Sand	Medium Sand	Fine Sand	Silt & Clay		Liquid Limit (W _L)	Plastic Limit (W _P)	Plasticity Index (I _p)						
BH NO : 1																			
0.00	1.00	Brown coloured Sand mixed with Clay	DS	SC	0.02	0.04	4.69	85.02	10.23	35	NP	NP	NP	0	0	17.56	2.62	0.00	29.00
1.00	2.00	Brown coloured Sand mixed with Clay	DS	SC	0.00	0.17	6.66	81.89	11.28	25	NP	NP	NP	0	0	17.59	2.63	0.00	29.00
2.00	3.00	Brown coloured Sand mixed with Clay	DS	SC	0.51	0.32	6.51	81.59	11.07	24	NP	NP	NP	0	0	17.63	2.63	0.00	30.00
3.00	4.00	Brown coloured Sand mixed with Clay	DS	SC	0.53	0.33	7.57	80.77	10.80	26	NP	NP	NP	0	0	17.65	2.62	0.00	30.00
4.00	5.50	Brown coloured Sand mixed with Clay	DS	SC	0.00	0.56	7.97	81.41	10.06	25	NP	NP	NP	0	0	17.70	2.63	0.00	31.00
5.50	7.00	Brown coloured Sand mixed with Clay	DS	SC	0.00	0.37	6.54	79.91	13.18	24	NP	NP	NP	0	0	17.79	2.64	0.00	32.00
7.00	8.50	Brown coloured Sand mixed with Clay	DS	SC	0.47	0.35	7.02	81.18	10.98	24	NP	NP	NP	0	0	17.86	2.64	0.00	32.00
8.50	10.00	Brown coloured Sand	DS	SP	0.51	0.37	7.77	82.14	9.21	25	NP	NP	NP	0	0	18.00	2.63	0.00	33.00
10.00	-	Brown coloured Sand	DS	SP	0.00	0.10	31.69	62.41	5.80	27	NP	NP	NP	0	0	18.16	2.62	0.00	33.00

DS = Disturbed Sample

NMC = Natural Moisture Content

NP = Non Plastic



Report No :131A / 2017-18 Dt :26.12.2017

TABLE: 1B

Name of Project : Sub Soil Investigation for the Construction of **SOLAR POWER PLANT** at V.O.Chidambaranar Port Trust, Tuticorin.

Depth of soil (m)		Soil Description	Type of sample collected	IS Classification	Grain Size Analysis (%)					NMC	Index Properties (%)			Free Swell Index (FSI) IN %	Swelling Pressure in KN/m ²	Bulk Density (KN/m ³) γ_w	Specific Gravity	Cohesion "C" in (Kg/cm ²)	Angle of friction (ϕ)	
From	To				Gravel	Coarse Sand	Medium Sand	Fine Sand	Silt & Clay		Liquid Limit (W _L)	Plastic Limit (W _P)	Plasticity Index (I _p)							
BH NO : 2																				
0.00	1.00	Brown coloured Sand mixed with Clay	DS	SC	0.03	0.02	3.89	84.23	11.83	27	NP	NP	NP	0	0	17.63	2.63	0.00	29.00	
1.00	2.00	Brown coloured Sand mixed with Clay	DS	SC	0.02	0.04	4.33	83.58	12.03	22	NP	NP	NP	0	0	17.68	2.63	0.00	30.00	
2.00	3.00	Brown coloured Sand	DS	SP	0.00	0.18	6.54	83.56	9.72	24	NP	NP	NP	0	0	17.71	2.62	0.00	30.00	
3.00	4.00	Brown coloured Sand mixed with Clay	DS	SC	0.24	0.83	6.57	81.63	10.73	25	NP	NP	NP	0	0	17.75	2.62	0.00	30.00	
4.00	5.50	Brown coloured Sand	DS	SP	0.00	0.32	6.30	86.68	6.70	24	NP	NP	NP	0	0	17.80	2.63	0.00	31.00	
5.50	7.00	Brown coloured Sand	DS	SP	0.00	0.00	0.35	95.96	3.69	17	NP	NP	NP	0	0	17.82	2.64	0.00	32.00	
7.00	8.05	Gray coloured Sand mixed with Clay	DS	SC	3.44	6.78	16.62	30.57	42.59	62	41.39	21.97	19.42	33	41	17.61	2.56	0.29	17.00	
8.05	10.00	Sand (Pieces of Soft Disintegrated Rock)	WS	SP	5.61	27.68	55.29	11.42	0.00	13	NP	NP	NP	0	0	18.33	2.65	0.00	38.00	
DS = Disturbed Sample		NMC = Natural Moisture Content					NP = Non Plastic					WS = Washing Sample								



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SOIL PROFILE AND SUMMARY OF LAB TEST RESULTS

Report No :131A / 2017-18 Dt :26.12.2017

TABLE: 1C

Name of Project : Sub Soil Investigation for the Construction of **SOLAR POWER PLANT** at V.O.Chidambaranar Port Trust, Tuticorin.

Depth of soil (m)		Soil Description	Type of sample collected	IS Classification	Grain Size Analysis (%)					NMC	Index Properties (%)			Free Swell Index (FSI) IN %	Swelling Pressure in KN/m ²	Bulk Density (KN/m ³) γ_w	Specific Gravity	Cohesion "C" in (Kg/cm ²)	Angle of friction (ϕ)
From	To				Gravel	Coarse Sand	Medium Sand	Fine Sand	Silt & Clay		Liquid Limit (W _L)	Plastic Limit (W _P)	Plasticity Index (I _p)						
BH NO : 3																			
0.00	1.00	Brown coloured Sand mixed with Clay	DS	SC	0.01	0.09	4.02	83.10	12.78	27	NP	NP	NP	0	0	17.55	2.62	0.00	29.00
1.00	2.00	Brown coloured Sand	DS	SP	0.00	0.00	0.30	94.29	5.41	24	NP	NP	NP	0	0	17.59	2.63	0.00	29.00
2.00	3.00	Brown coloured Sand	DS	SP	0.00	0.00	1.71	95.60	2.69	15	NP	NP	NP	0	0	17.59	2.64	0.00	29.00
3.00	4.00	Brown coloured Sand	DS	SP	0.00	0.00	1.30	94.48	4.22	15	NP	NP	NP	0	0	17.60	2.64	0.00	30.00
4.00	5.50	Brown coloured Sand	DS	SP	0.00	0.03	4.23	91.55	4.19	24	NP	NP	NP	0	0	17.62	2.63	0.00	31.00
5.50	7.00	Gray coloured Clay mixed with Sand	DS	CH	1.31	0.13	16.18	31.81	50.57	51	48.31	24.63	23.68	46	78	17.31	2.57	0.38	13.00
7.00	8.75	Gray coloured Clay mixed with Sand	DS	CH	0.31	0.27	15.64	32.05	51.73	45	54.28	27.81	26.47	41	74	17.33	2.56	0.40	13.00
8.75	10.00	Sand (Pieces of Soft Disintegrated Rock)	WS	SP	6.40	24.26	51.46	17.88	0.00	6	NP	NP	NP	0	0	18.56	2.64	0.00	39.00

DS = Disturbed Sample

NMC = Natural Moisture Content

NP = Non Plastic

WS = Washing Sample



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ANNEXURE - A

NATURAL MOISTURE CONTENT

(Test method As per IS 2720 (Part 2) - 1973)

Name of Project : Sub Soil Investigation for the Construction of **SOLAR POWER PLANT** at V.O.Chidambaranar Port Trust, Tuticorin.

BH. No	1		1		1	
Depth (m)	0.50 m		1.00 m		2.00 m	
Wt of Tare (W) gm	75.93	75.41	77.24	77.86	76.03	76.11
Tare + Wet Soil (W_1) gm	106.41	106.27	105.34	105.98	107.11	107.89
Tare + Dry Soil (W_2) gm	98.48	98.32	99.76	100.32	101.15	101.71
Wt of Water ($W_3 = W_1 - W_2$) gm	7.93	7.95	5.58	5.66	5.96	6.18
Wt Dry Soil ($W_4 = W_2 - W$) gm	22.55	22.91	22.52	22.46	25.12	25.60
Water Content (%) = $(W_3 / W_4) \times 100$	35.17	34.70	24.78	25.20	23.73	24.14
Average Water Content (%)	35		25		24	



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ANNEXURE - B

SPECIFIC GRAVITY

(Test method As per IS 2720 (Part 3) - 1980)

Name of Project : Sub Soil Investigation for the Construction of **SOLAR POWER PLANT** at V.O.Chidambaranar Port Trust, Tuticorin.

BH. No	1		1		1	
Depth (m)	0.50 m		1.00 m		2.00 m	
Bottle Number	1	2	1	2	1	2
Weight of empty Bottle (w_1) gm	36.56	34.04	36.56	34.04	36.56	34.04
Weight of bottle + Sample (w_2) gm	50.32	50.11	52.75	52.89	51.19	51.47
Weight of bottle + Sample + Water (w_3)gm	95.96	96.60	97.48	98.35	96.52	97.46
Weight of bottle + Water (w_4) gm	87.45	86.66	87.45	86.66	87.45	86.66
Specific Gravity = $(w_2 - w_1) / (w_4 - w_1) - (w_3 - w_2)$	2.62	2.62	2.63	2.63	2.63	2.63
Average value for Specific Gravity	2.62		2.63		2.63	



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ANNEXURE - C

GRAIN SIZE ANALYSIS
(Test method As per IS 2720 (Part 4) - 1985)

Name of Project : Sub Soil Investigation for the Construction of **SOLAR POWER PLANT** at V.O.Chidambaranar Port Trust, Tuticorin.

Weight of Soil taken for analysis **Ws** 100.00 g

Borehole No. 2

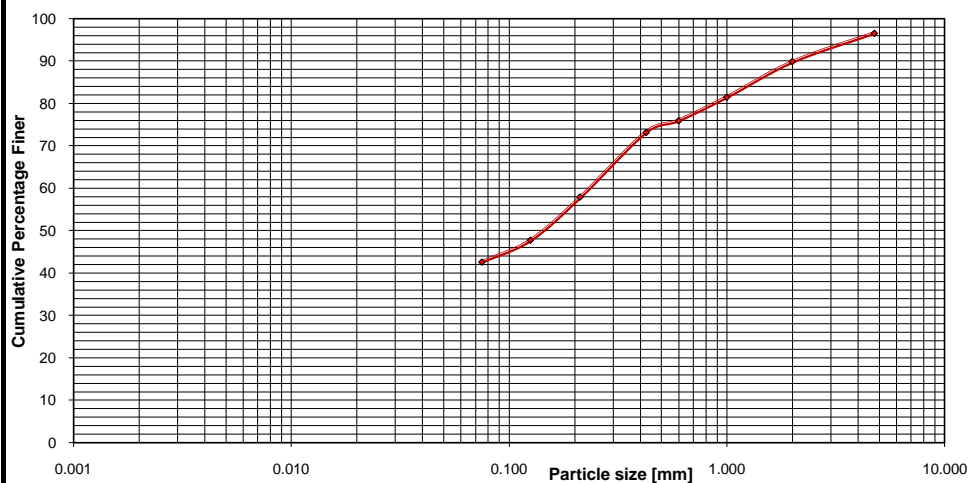
Weight of Soil more than 0.075mm IS Sieve 57.41 g

Depth (m) 7.00 m

S.No.	Size of sieves	% Soil retained PSR % (1)	Cumulative % Finer F % (2)	Average Sieve size (mm) (3)	Product of Columns (1) x (3)
1	4.750	3.44	96.56	4.750	16.34
2	2.000	6.78	89.78	3.375	22.88
3	1.000	8.31	81.47	1.500	12.47
4	0.600	5.54	75.93	0.800	4.43
5	0.425	2.77	73.16	0.513	1.42
6	0.212	15.29	57.88	0.319	4.87
7	0.125	10.19	47.69	0.181	1.84
8	0.075	5.10	42.59	0.113	0.57
9	passing 0.075				64.825

Average Particle Diameter = 0.6753

Clay	Fine	Silt Medium	Coarse	Fine	Sand Medium	Coarse	Gravel Fine
------	------	----------------	--------	------	----------------	--------	----------------



Soil description : Sand mixed with Clay

Based on Gradation Curve, the following sizes of Material (as per IS 1498 - 1970) are obtained

Classification of soil	%
Gravel	3.44
Course Sand	6.78
Medium Sand	16.62
Fine Sand	30.57
Silt & Clay	42.59



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ANNEXURE - D

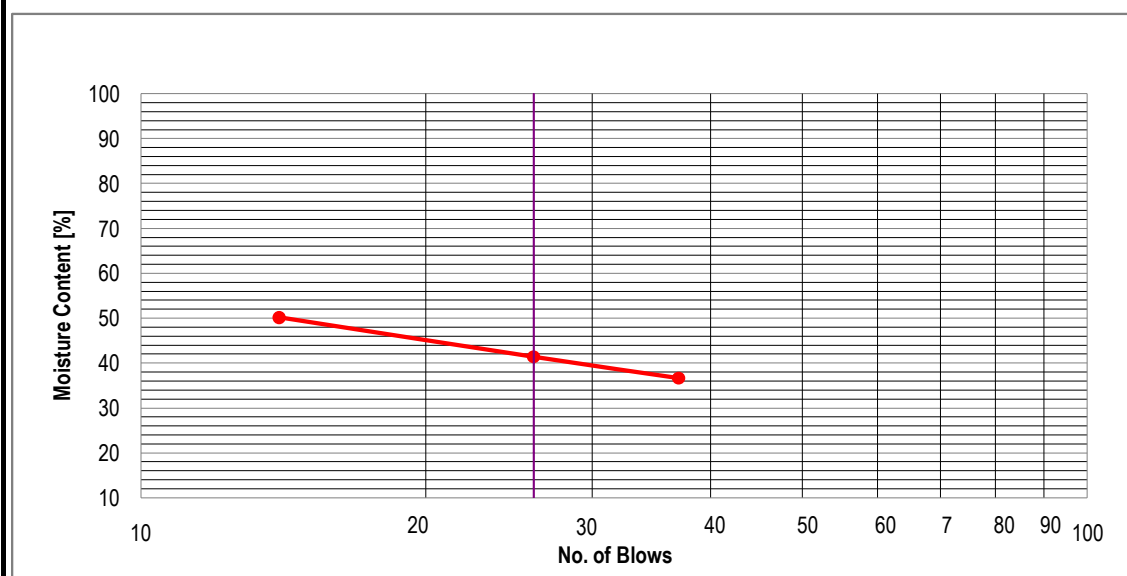
LIQUID LIMIT & PLASTIC LIMIT

(Test method As per IS 2720 (Part 5) - 1985)

Name of Project : Sub Soil Investigation for the Construction of **SOLAR POWER PLANT** at V.O.Chidambaranar Port Trust, Tuticorin.

Report No	131A / 2017-18 Dt.25.12.2017
Borehole No	2
Depth	7.00 m

Description		Liquid Limit			Plastic Limit	
No. of Blows	N	14	26	37		
Weight of Wet Specimen + Container	WSC g	72.69	86.64	71.56	69.89	64.74
Weight of Dry Specimen + Container	WDC g	69.78	83.78	69.71	68.85	63.75
Weight of Container	WC g	63.98	76.87	64.66	64.15	59.21
Weight of Water	WW g	2.91	2.86	1.85	1.04	0.99
Weight of Dry Specimen	WD g	5.80	6.91	5.05	4.70	4.54
Moisture Content	W %	50.17	41.39	36.63	22.13	21.81



Liquid Limit	W_L :	41.39 %
Plastic Limit	W_P :	21.97 %
Plasticity Index	I_P :	19.42 %

Plasticity Index [%]					
*					
0	20	40	60	80	100



Direct Shear Test
(Test method As per IS 2720 (Part 13) - 1986)

Name of Project : Sub Soil Investigation for the Construction of **SOLAR POWER PLANT** at V.O.Chidambaranar Port Trust, Tuticorin.

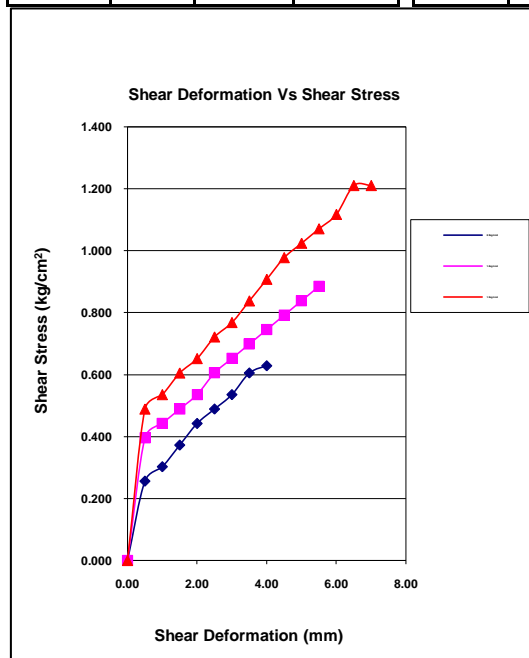
Borehole No	1
Depth (m)	2.00 m
Date of Test	26.12.2017

L.C of Dial gauge	:	0.01
Proving Ring Constant	:	0.81421
Area of the Specimen	:	36

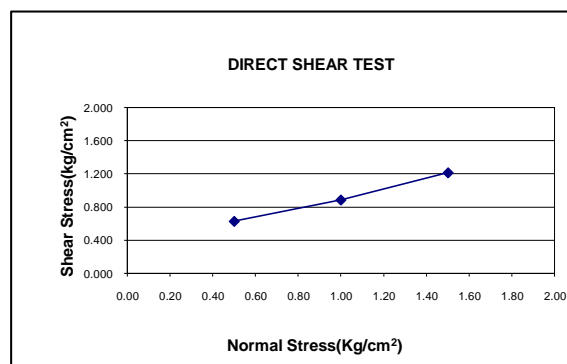
Trail-1			
Normal Stress: 0.5 kg/cm ²			
Horizontal Gauge Reading	Proving Ring Reading	Shear deformation	Shear Stress (kg/Cm ²)
0	0	0.00	0.000
50	11.329	0.50	0.256
100	13.388	1.00	0.303
150	16.478	1.50	0.373
200	19.568	2.00	0.443
250	21.627	2.50	0.489
300	23.687	3.00	0.536
350	26.777	3.50	0.606
400	27.807	4.00	0.629

Trail-2			
Normal Stress: 1.0 kg/cm ²			
Horizontal Gauge Reading	Proving Ring Reading	Shear deformation	Shear Stress (kg/Cm ²)
0	0	0.00	0.000
50	17.508	0.50	0.396
100	19.5677	1.00	0.443
150	21.6275	1.50	0.489
200	23.6872	2.00	0.536
250	26.7769	2.50	0.606
300	28.8366	3.00	0.652
350	30.8964	3.50	0.699
400	32.9561	4.00	0.745
450	35.0159	4.50	0.792
500	37.0757	5.00	0.839
550	39.1354	5.50	0.885

Trail-3			
Normal Stress: 1.5 kg/cm ²			
Horizontal Gauge Reading	Proving Ring Reading	Shear deformation	Shear Stress (kg/Cm ²)
0	0	0.00	0.000
50	21.627	0.50	0.489
100	23.687	1.00	0.536
150	26.777	1.50	0.606
200	28.837	2.00	0.652
250	31.926	2.50	0.722
300	33.986	3.00	0.769
350	37.076	3.50	0.839
400	40.165	4.00	0.908
450	43.255	4.50	0.978
500	45.315	5.00	1.025
550	47.374	5.50	1.071
600	49.434	6.00	1.118
650	53.554	6.50	1.211
700	53.554	7.00	1.211



Normal Stress (kg/cm ²)	Proving Ring reading at failure	Shear Stress (kg/cm ²)
0.50	27.8067495	0.629
1.00	39.13542523	0.885
1.50	53.55373978	1.211



1. Angle of Shearing Resistance (Φ) 30 Degrees
2. Cohesion (C) = 0.00 Kg/cm²



DENSITY CALCULATION

Name of Project : Sub Soil Investigation for the Construction of **SOLAR POWER PLANT** at V.O.Chidambaranar Port Trust, Tuticorin.

Borehole No.	1
Depth (m)	0.50

Sl. No.	Description	Reading
1	Weight of Empty Box (gm)	3,393.00
2	Weight of Box + Soil (gm)	3,551.00
3	Weight of Soil (gm)	158.00
4	Volume of Box (cm ³)	90.00
5	Bulk Density (gm /cm ³)	1.756
6	Weight of Container (gm)	45.33
7	Weight of Container + Wet Soil (gm)	63.87
8	Weight of Container + Dry Soil (gm)	62.16
9	Moisture Content (%)	10.16
10	Dry Density (gm /cm ³)	1.594

RESULT

- 1 WET DENSITY OF SOIL = 1.756 t / m³
- 2 DRY DENSITY OF SOIL = 1.594 t / m³



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ANNEXURE - G

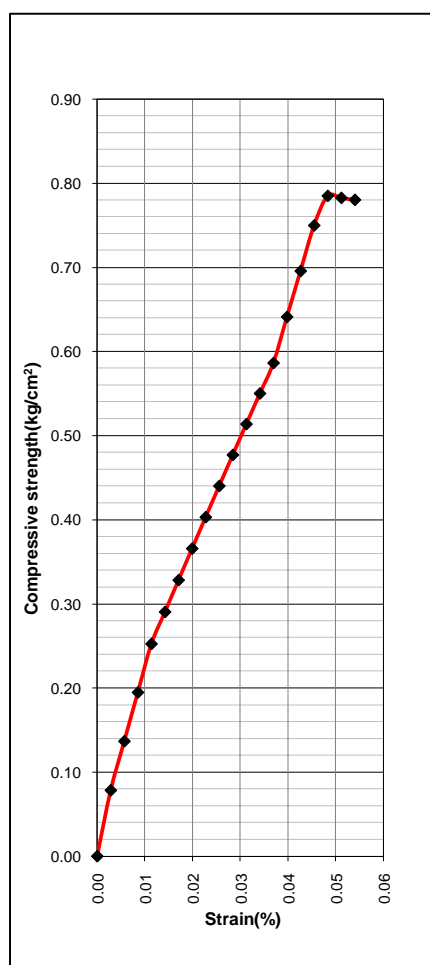
Unconfined Compression Test
(Test method As per IS 2720 (Part 10) - 1995)

Name of Project : Sub Soil Investigation for the Construction of **SOLAR POWER PLANT** at V.O.Chidambaranar Port Trust, Tuticorin.

Diameter	38 mm
Length	88 mm
Constant	0.31530

Borehole No	3
Depth (m)	7.00 m
Date of Test	26.12.2017

Deformation dial Reading	Axial deformation (mm)	Axial Strain (e)	Area (cm ²)	Proving Ring Readings	Axial force N (Kgf)	Compressive strength (kg/cm ²)
(1)	(2)	(3)	(4)	(5)	(6)	(7)
0.00	0.00	0.00	11.35	0.00	0.000	0.00
25.00	0.25	0.00	11.38	2.83	0.891	0.08
50.00	0.50	0.01	11.41	4.95	1.560	0.14
75.00	0.75	0.01	11.45	7.07	2.228	0.19
100.00	1.00	0.01	11.48	9.19	2.897	0.25
125.00	1.25	0.01	11.51	10.60	3.342	0.29
150.00	1.50	0.02	11.55	12.01	3.788	0.33
175.00	1.75	0.02	11.58	13.43	4.234	0.37
200.00	2.00	0.02	11.61	14.84	4.679	0.40
225.00	2.25	0.03	11.65	16.25	5.125	0.44
250.00	2.50	0.03	11.68	17.67	5.571	0.48
275.00	2.75	0.03	11.72	19.08	6.016	0.51
300.00	3.00	0.03	11.75	20.49	6.462	0.55
325.00	3.25	0.04	11.79	21.91	6.908	0.59
350.00	3.50	0.04	11.82	24.03	7.576	0.64
375.00	3.75	0.04	11.86	26.15	8.245	0.70
400.00	4.00	0.05	11.89	28.27	8.913	0.75
425.00	4.25	0.05	11.93	29.68	9.359	0.78
450.00	4.50	0.05	11.96	29.68	9.359	0.78
475.00	4.75	0.05	12.00	29.68	9.359	0.78



Results:

$$q_u = 0.785 \text{ kg/cm}^2$$

$$\text{Cohesion} = C = 0.400 \text{ kg/cm}^2$$



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ANNEXURE: H

FREE SWELL INDEX OF SOIL

(As per IS: 2720, Part-40, 1977)

Name of Project : Sub Soil Investigation for the Construction of **SOLAR POWER PLANT** at V.O.Chidambaranar Port Trust, Tuticorin.

Borehole No.	3
Depth (m)	7

Sample No.	Height of soil in water (mm)	Height of soil in Kerosene (mm)	Volume of Soil in Cylinder Containing Distilled Water (V_d) in mm ³	Volume of Soil in Cylinder Containing Kerosene (V_k) in mm ³	Free Swell Index ($(V_d - V_k / V_k) * 100$ in %)
1	24	17	20527	14540	41



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ANNEXURE - I

TEST REPORT ON CHEMICAL ANALYSIS OF WATER SAMPLE

Date :26.12.2017

Name and Address to whom this report is issued

THE ASSISTANT EXECUTIVE ENGINEER WS & PH,
V.O.Chidambaranar Port Trust,
Civil Engineering Department,
Administrative Office,
Tuticorin - 628 004.

Source of Sample

Bore water - 1

Name of Work

Construction of **SOLAR POWER PLANT** at
V.O.Chidambaranar Port Trust,Tuticorin.

Type of Test	Observed Values	IS Requirements as Per WHO Standard (not more than the value)	Remarks
Organic Solides	173.26 mg/l	200 Mg./L Max.	With in the limit
Inorganic Solides	2611.27 mg/l	3000 Mg./L Max.	With in the limit
Sulphates (as SO)	618.02 mg/l	400 Mg./L Max.	Exceeding the limit
Chlorides (as Cl)	2127.60 mg/l	Max.2000 mg/l for concrete	Exceeding the limit
		Max. 500 mg/l for RCC	
Suspended Mater	171.88 mg/l	2000 Mg/L Max.	With in the limit
pH	8.12	6.5 to 8.5	With in the limit

Conclusion : As per WHO Standards, the given Water Sample is **Not Suitable** for **Construction works**.



GEOMATRIX CONSULTANCY
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TEST REPORT ON CHEMICAL ANALYSIS OF WATER SAMPLE

Date :26.12.2017

Name and Address to whom this report is issued

THE ASSISTANT EXECUTIVE ENGINEER WS & PH,
V.O.Chidambaranar Port Trust,
Civil Engineering Department,
Administrative Office,
Tuticorin - 628 004.

Source of Sample

Bore water - 2

Name of Work

Construction of **SOLAR POWER PLANT** at
V.O.Chidambaranar Port Trust,Tuticorin.

Type of Test	Observed Values	IS Requirements as Per WHO Standard (not more than the value)	Remarks
Organic Solides	174.78 mg/l	200 Mg./L Max.	With in the limit
Inorganic Solides	2786.42 mg/l	3000 Mg./L Max.	With in the limit
Sulphates (as SO)	568.96 mg/l	400 Mg./L Max.	Exceeding the limit
Chlorides (as Cl)	2242.17 mg/l	Max.2000 mg/l for concrete	Exceeding the limit
		Max. 500 mg/l for RCC	
Suspended Mater	172.56 mg/l	2000 Mg/L Max.	With in the limit
pH	8.23	6.5 to 8.5	With in the limit

Conclusion : As per WHO Standards, the given Water Sample is **Not Suitable** for **Construction works**.



LOAD CARRYING CAPACITY OF PILES

(As per IS : 2911 (Part I / Sec 2) - 1979) APPENDIX B

Name of Project : Sub Soil Investigation for the Construction of **SOLAR POWER PLANT** at V.O.Chidambaranar Port Trust, Tuticorin.

Borehole No. : 1

Dia of Pile : 0.30 m

LENGTH OF PILE : 1.00 m

Coefficient (K) : 0.30

Factor of safety : 3

RL of bottom of pile cap : -RL .500 m

Depth of Soil layers from Bed Level

Description	Depths	Levels
1st Layer	0.50 m	-RL 1.000 m
2nd Layer	0.50 m	-RL 1.500 m

1st Layer

Ultimate Side Resistance or Skin Friction

Type of Soil = Sand mixed with Clay
Dia of Pile = 0.30 m
Thickness of the Layer = 0.500 m
Angle of Internal friction (ϕ) = 29.0°
Average cohesion , C = 0.00 t/Sq.m
Unit weight of Soil g = 1.756 t/Cu.m
Coefficient of earth pressure (k) = 0.30
Reduction Factor a = 0.7
Surface Area (As) = 0.471 Sq.m
Average Overburden Pressure (P_{di}) = Depth of layer x Unit Weight of soil
= 0.5 x 1.756
Average Overburden Pressure (P_{di}) = 0.878 t/Sq.m
Skin Friction (Rf) = $KP_{di} \tan \phi A_{si} + (a \times C \times A_s)$
= $(0.3 \times 0.88 \times \tan 29 \times 0.471) + (0.7 \times 0 \times 0.471)$
Rf = 0.07 t

2nd Layer

Ultimate Side Resistance or Skin Friction

Type of Soil = Sand mixed with Clay
Dia of Pile = 0.30 m
Thickness of the Layer = 0.500 m
Angle of Internal friction (ϕ) = 29.0°
Average cohesion , C = 0.00 t/Sq.m
Unit weight of Soil g = 1.759 t/Cu.m
Coefficient of earth pressure (k) = 0.30
Reduction Factor a = 0.5
Surface Area (As) = 0.471 Sq.m
Average Overburden Pressure (P_{di}) = Depth of layer x Unit Weight of soil
= 0.5 x 1.759
Average Overburden Pressure (P_{di}) = 1.758 t/Sq.m
Skin Friction (Rf) = $KP_{di} \tan \phi A_{si} + (a \times C \times A_s)$
= $(0.3 \times 1.76 \times \tan 29 \times 0.471) + (0.5 \times 0 \times 0.471)$
Rf = 0.14 t

Total Skin Friction = 0.21 t 2.1 kN

End Bearing Resistance

Type of Soil	=	Sand mixed with Clay
Dia of Pile	=	0.30 m
Angle of Internal friction (ϕ)	=	29.0°
Average cohesion at pile tip (C_p)	=	0.00 t/Sq.m
Submerged unit weight of Soil γ	=	0.759 t/Cu.m
Area of Cross section(A_p)	=	0.071 Sq.m
Average Overburden Pressure (P_{av})	=	0.759 t/Sq.m
N_γ	=	20.1 (From IS 6403:1981 for $\phi = 29^\circ$)
N_q	=	16.85
N_c	=	28.26
End Bearing Resistance (R_u)	=	$A_p * (1/2 D. \gamma . N_\gamma) + (P_{av} . N_q) + (N_c . C_p)$
	=	$0.071 \times (1/2 \times 0.3 \times 0.759 \times 20.1 + (0.759 \times 16.85) + 0.071 \times 28.26 \times 0$
R_u	=	12.95 t 130 kN
Q_u	=	0.207 + 12.951
Total Ultimate Pile carrying Capacity	=	13.16 t 132 kN
Allowable Pile Capacity	=	13.157 / 3
Capacity of pile, KN	=	4.39 t
	=	43.86 KN

FINAL RESULT :

1	Ultimate compression Capacity	=	132 kN
2	Ultimate Pull out Capacity	=	2.1 kN
3	Factor of Safety	=	3
4	Safe compression Capacity in KN	=	43.86 KN
5	Safe Pull out Capacity in KN	=	0.69 KN



LOAD CARRYING CAPACITY OF PILES

(As per IS : 2911 (Part I / Sec 2) - 1979) APPENDIX B

Name of Project : Sub Soil Investigation for the Construction of **SOLAR POWER PLANT** at V.O.Chidambaranar Port Trust, Tuticorin.

Borehole No. : 2

Dia of Pile : 0.30 m

LENGTH OF PILE : 1.00 m

Coefficient (K) : 0.30

Factor of safety : 3

RL of bottom of pile cap : -RL .500 m

Depth of Soil layers from Bed Level

Description	Depths	Levels
1st Layer	0.50 m	-RL 1.000 m
2nd Layer	0.50 m	-RL 1.500 m

1st Layer

Ultimate Side Resistance or Skin Friction

Type of Soil = Sand mixed with Clay
Dia of Pile = 0.30 m
Thickness of the Layer = 0.500 m
Angle of Internal friction (ϕ) = 29.0°
Average cohesion , C = 0.00 t/Sq.m
Unit weight of Soil g = 1.763 t/Cu.m
Coefficient of earth pressure (k) = 0.30
Reduction Factor a = 0.5
Surface Area (As) = 0.471 Sq.m
Average Overburden Pressure (P_{di}) = Depth of layer x Unit Weight of soil
= 0.5 x 1.763
Average Overburden Pressure (P_{di}) = 0.882 t/Sq.m
Skin Friction (Rf) = $KP_{di} \tan \phi A_{si} + (a \times C \times A_s)$
= (0.3 x 0.88 x $\tan 29$ x 0.471) + (0.5 x 0 x 0.471)
Rf = 0.07 t

2nd Layer

Ultimate Side Resistance or Skin Friction

Type of Soil = Sand mixed with Clay
Dia of Pile = 0.30 m
Thickness of the Layer = 0.500 m
Angle of Internal friction (ϕ) = 30.0°
Average cohesion , C = 0.00 t/Sq.m
Unit weight of Soil g = 1.768 t/Cu.m
Coefficient of earth pressure (k) = 0.30
Reduction Factor a = 0.4
Surface Area (As) = 0.471 Sq.m
Average Overburden Pressure (P_{di}) = Depth of layer x Unit Weight of soil
= 0.5 x 1.768
Average Overburden Pressure (P_{di}) = 1.766 t/Sq.m
Skin Friction (Rf) = $KP_{di} \tan \phi A_{si} + (a \times C \times A_s)$
= (0.3 x 1.77 x $\tan 30$ x 0.471) + (0.4 x 0 x 0.471)
Rf = 0.14 t

Total Skin Friction = 0.21 t 2.1 kN

End Bearing Resistance

Type of Soil	=	Sand mixed with Clay
Dia of Pile	=	0.30 m
Angle of Internal friction (ϕ)	=	30.0°
Average cohesion at pile tip (C_p)	=	0.00 t/Sq.m
Submerged unit weight of Soil γ	=	0.768 t/Cu.m
Area of Cross section(A_p)	=	0.071 Sq.m
Average Overburden Pressure (P_{av})	=	0.768 t/Sq.m
N_γ	=	22.4 (From IS 6403:1981 for $\phi = 30^\circ$)
N_q	=	18.40
N_c	=	30.14
End Bearing Resistance (R_u)	=	$A_p * (1/2 D. \gamma . N_\gamma) + (P_{av} . N_q) + (N_c . C_p)$
	=	$0.071 \times (1/2 \times 0.3 \times 0.768 \times 22.4 + (0.768 \times 18.4) + 0.071 \times 30.14 \times 0$
R_u	=	14.31 t 143 kN
Q_u	=	$0.213 + 14.314$
Total Ultimate Pile carrying Capacity	=	14.53 t 145 kN
Allowable Pile Capacity	=	$14.527 / 3$ 4.84 t
Capacity of pile, KN	=	48.42 KN

FINAL RESULT :

1	Ultimate compression Capacity	=	145 kN
2	Ultimate Pull out Capacity	=	2.1 kN
3	Factor of Safety	=	3
4	Safe compression Capacity in KN	=	48.42 KN
5	Safe Pull out Capacity in KN	=	0.71 KN



LOAD CARRYING CAPACITY OF PILES

(As per IS : 2911 (Part I / Sec 2) - 1979) APPENDIX B

Name of Project : Sub Soil Investigation for the Construction of **SOLAR POWER PLANT** at V.O.Chidambaranar Port Trust, Tuticorin.

Borehole No. : 3

Dia of Pile : 0.30 m

LENGTH OF PILE : 1.00 m

Coefficient (K) : 0.30

Factor of safety : 3

RL of bottom of pile cap : -RL .500 m

Depth of Soil layers from Bed Level

Description	Depths	Levels
1st Layer	0.50 m	-RL 1.000 m
2nd Layer	0.50 m	-RL 1.500 m

1st Layer

Ultimate Side Resistance or Skin Friction

Type of Soil = Sand mixed with Clay
Dia of Pile = 0.30 m
Thickness of the Layer = 0.500 m
Angle of Internal friction (ϕ) = 29.0°
Average cohesion , C = 0.00 t/Sq.m
Unit weight of Soil g = 1.755 t/Cu.m
Coefficient of earth pressure (k) = 0.30
Reduction Factor a = 0.5
Surface Area (As) = 0.471 Sq.m
Average Overburden Pressure (P_{di}) = Depth of layer x Unit Weight of soil
= 0.5 x 1.755
Average Overburden Pressure (P_{di}) = 0.878 t/Sq.m
Skin Friction (Rf) = $KP_{di} \tan \phi A_{si} + (a \times C \times A_s)$
= $(0.3 \times 0.88 \times \tan 29 \times 0.471) + (0.5 \times 0 \times 0.471)$
Rf = 0.07 t

2nd Layer

Ultimate Side Resistance or Skin Friction

Type of Soil = Sand
Dia of Pile = 0.30 m
Thickness of the Layer = 0.500 m
Angle of Internal friction (ϕ) = 29.0°
Average cohesion , C = 0.00 t/Sq.m
Unit weight of Soil g = 1.759 t/Cu.m
Coefficient of earth pressure (k) = 0.30
Reduction Factor a = 0.5
Surface Area (As) = 0.471 Sq.m
Average Overburden Pressure (P_{di}) = Depth of layer x Unit Weight of soil
= 0.5 x 1.759
Average Overburden Pressure (P_{di}) = 1.757 t/Sq.m
Skin Friction (Rf) = $KP_{di} \tan \phi A_{si} + (a \times C \times A_s)$
= $(0.3 \times 1.76 \times \tan 29 \times 0.471) + (0.5 \times 0 \times 0.471)$
Rf = 0.14 t

Total Skin Friction = 0.21 t 2.1 kN

End Bearing Resistance

Type of Soil	=	Sand
Dia of Pile	=	0.30 m
Angle of Internal friction (ϕ)	=	29.0°
Average cohesion at pile tip (C_p)	=	0.00 t/Sq.m
Submerged unit weight of Soil γ	=	0.759 t/Cu.m
Area of Cross section(A_p)	=	0.071 Sq.m
Average Overburden Pressure (P_{av})	=	0.759 t/Sq.m
N_y	=	20.1 (From IS 6403:1981 for $\phi = 29^\circ$)
N_q	=	16.85
N_c	=	28.26
End Bearing Resistance (R_u)	=	$A_p * (1/2 D. \gamma . N_y) + (P_{av} . N_q) + (N_c . C_p)$
	=	$0.071 \times (1/2 \times 0.3 \times 0.759 \times 20.1) + (0.759 \times 16.85) + 0.071 \times 28.26 \times 0$
R_u	=	12.95 t 130 kN
Q_u	=	0.206 + 12.951
Total Ultimate Pile carrying Capacity	=	13.16 t 132 kN
Allowable Pile Capacity	=	13.157 / 3
Capacity of pile, KN	=	4.39 t
	=	43.86 KN

FINAL RESULT :

1	Ultimate compression Capacity	=	132 kN
2	Ultimate Pull out Capacity	=	2.1 kN
3	Factor of Safety	=	3
4	Safe compression Capacity in KN	=	43.86 KN
5	Safe Pull out Capacity in KN	=	0.69 KN



LOAD CARRYING CAPACITY OF PILES

(As per IS : 2911 (Part I / Sec 2) - 1979) APPENDIX B

Name of Project : Sub Soil Investigation for the Construction of **SOLAR POWER PLANT** at V.O.Chidambaranar Port Trust, Tuticorin.

Borehole No. : 1

Dia of Pile : 0.30 m

LENGTH OF PILE : 1.50 m

Coefficient (K) : 0.30

Factor of safety : 3

RL of bottom of pile cap : -RL .500 m

Depth of Soil layers from Bed Level

Description	Depths	Levels
1st Layer	0.50 m	-RL 1.000 m
2nd Layer	1.00 m	-RL 2.000 m

1st Layer

Ultimate Side Resistance or Skin Friction

Type of Soil = Sand mixed with Clay
Dia of Pile = 0.30 m
Thickness of the Layer = 0.500 m
Angle of Internal friction (ϕ) = 29.0°
Average cohesion , C = 0.00 t/Sq.m
Unit weight of Soil g = 1.756 t/Cu.m
Coefficient of earth pressure (k) = 0.30
Reduction Factor a = 0.7
Surface Area (As) = 0.471 Sq.m
Average Overburden Pressure (P_{di}) = Depth of layer x Unit Weight of soil
= 0.5 x 1.756
Average Overburden Pressure (P_{di}) = 0.878 t/Sq.m
Skin Friction (Rf) = $KP_{di} \tan \phi A_{si} + (a \times C \times A_s)$
= (0.3 x 0.88 x tan 29 x 0.471) + (0.7 x 0 x 0.471)
Rf = 0.07 t

2nd Layer

Ultimate Side Resistance or Skin Friction

Type of Soil = Sand mixed with Clay
Dia of Pile = 0.30 m
Thickness of the Layer = 1.000 m
Angle of Internal friction (ϕ) = 29.0°
Average cohesion , C = 0.00 t/Sq.m
Unit weight of Soil g = 1.759 t/Cu.m
Coefficient of earth pressure (k) = 0.30
Reduction Factor a = 0.5
Surface Area (As) = 0.942 Sq.m
Average Overburden Pressure (P_{di}) = Depth of layer x Unit Weight of soil
= 1 x 1.759
Average Overburden Pressure (P_{di}) = 2.637 t/Sq.m
Skin Friction (Rf) = $KP_{di} \tan \phi A_{si} + (a \times C \times A_s)$
= (0.3 x 2.64 x tan 29 x 0.942) + (0.5 x 0 x 0.942)
Rf = 0.41 t

Total Skin Friction = 0.48 t 4.8 kN

End Bearing Resistance

Type of Soil	=	Sand mixed with Clay
Dia of Pile	=	0.30 m
Angle of Internal friction (ϕ)	=	30.0°
Average cohesion at pile tip (C_p)	=	0.00 t/Sq.m
Submerged unit weight of Soil γ	=	0.763 t/Cu.m
Area of Cross section(A_p)	=	0.071 Sq.m
Average Overburden Pressure (P_{av})	=	0.763 t/Sq.m
N_y	=	22.4 (From IS 6403:1981 for $\phi = 30^\circ$)
N_q	=	18.40
N_c	=	30.14
End Bearing Resistance (R_u)	=	$A_p * (1/2 D. \gamma . N_y) + (P_{av} . N_q) + (N_c . C_p)$
	=	$0.071 \times (1/2 \times 0.3 \times 0.763 \times 22.4 + (0.763 \times 18.4) + 0.071 \times 30.14 \times 0$
R_u	=	14.22 t 142 kN
Q_u	=	0.482 + 14.22
Total Ultimate Pile carrying Capacity	=	14.70 t 147 kN
Allowable Pile Capacity	=	14.703 / 3
Capacity of pile, KN	=	4.90 t

FINAL RESULT :

1	Ultimate compression Capacity	=	147 kN
2	Ultimate Pull out Capacity	=	4.8 kN
3	Factor of Safety	=	3
4	Safe compression Capacity in KN	=	49.01 KN
5	Safe Pull out Capacity in KN	=	1.61 KN



LOAD CARRYING CAPACITY OF PILES

(As per IS : 2911 (Part I / Sec 2) - 1979) APPENDIX B

Name of Project : Sub Soil Investigation for the Construction of **SOLAR POWER PLANT** at V.O.Chidambaranar Port Trust, Tuticorin.

Borehole No. : 2

Dia of Pile : 0.30 m

LENGTH OF PILE : 1.50 m

Coefficient (K) : 0.30

Factor of safety : 3

RL of bottom of pile cap : -RL .500 m

Depth of Soil layers from Bed Level

Description	Depths	Levels
1st Layer	0.50 m	-RL 1.000 m
2nd Layer	1.00 m	-RL 2.000 m

1st Layer

Ultimate Side Resistance or Skin Friction

Type of Soil = Sand mixed with Clay
Dia of Pile = 0.30 m
Thickness of the Layer = 0.500 m
Angle of Internal friction (ϕ) = 29.0°
Average cohesion , C = 0.00 t/Sq.m
Unit weight of Soil g = 1.763 t/Cu.m
Coefficient of earth pressure (k) = 0.30
Reduction Factor a = 0.5
Surface Area (As) = 0.471 Sq.m
Average Overburden Pressure (P_{di}) = Depth of layer x Unit Weight of soil
= 0.5 x 1.763
Average Overburden Pressure (P_{di}) = 0.882 t/Sq.m
Skin Friction (Rf) = $KP_{di} \tan \phi A_{si} + (a \times C \times A_s)$
= (0.3 x 0.88 x tan 29 x 0.471) + (0.5 x 0 x 0.471)
Rf = 0.07 t

2nd Layer

Ultimate Side Resistance or Skin Friction

Type of Soil = Sand mixed with Clay
Dia of Pile = 0.30 m
Thickness of the Layer = 1.000 m
Angle of Internal friction (ϕ) = 30.0°
Average cohesion , C = 0.00 t/Sq.m
Unit weight of Soil g = 1.768 t/Cu.m
Coefficient of earth pressure (k) = 0.30
Reduction Factor a = 0.4
Surface Area (As) = 0.942 Sq.m
Average Overburden Pressure (P_{di}) = Depth of layer x Unit Weight of soil
= 1 x 1.768
Average Overburden Pressure (P_{di}) = 2.650 t/Sq.m
Skin Friction (Rf) = $KP_{di} \tan \phi A_{si} + (a \times C \times A_s)$
= (0.3 x 2.65 x tan 30 x 0.942) + (0.4 x 0 x 0.942)
Rf = 0.43 t

Total Skin Friction		=	0.50 t	5.0 kN
End Bearing Resistance				
Type of Soil	=	Sand		
Dia of Pile	=	0.30 m		
Angle of Internal friction (ø)	=	30.0°		
Average cohesion at pile tip (Cp)	=	0.00 t/Sq.m		
Submerged unit weight of Soil g	=	0.763 t/Cu.m		
Area of Cross section(Ap)	=	0.071 Sq.m		
Average Overburden Pressure (P _{av})	=	0.763 t/Sq.m		
N _y	=	22.4	(From IS 6403:1981 for ø = 30°)	
N _q	=	18.40		
N _c	=	30.14		
End Bearing Resistance (Ru)	=	$A_p * (1/2 D. \gamma .N_q) + (P_{av} .N_q) + (N_c .C_p)$ $= 0.071 \times (1/2 \times 0.3 \times 0.763 \times 22.4 + (0.763 \times 18.4) + 0.071 \times 30.14 \times 0$		
Ru	=	14.22 t	142 kN	
QU	=	0.502 + 14.22		
Total Ultimate Pile carrying Capacity	=	14.72 t	147 kN	
Allowable Pile Capacity	=	14.722 / 3	<div>4.91 t</div>	
Capacity of pile, KN	=	49.07 KN		
FINAL RESULT :				
1	Ultimate compression Capacity	=	147 kN	
2	Ultimate Pull out Capacity	=	5.0 kN	
3	Factor of Safety	=	3	
4	Safe compression Capacity in KN	=	49.07 KN	
5	Safe Pull out Capacity in KN	=	1.67 KN	



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CALCULATION :2C

LOAD CARRYING CAPACITY OF PILES

(As per IS : 2911 (Part I / Sec 2) - 1979) APPENDIX B

Name of Project : Sub Soil Investigation for the Construction of **SOLAR POWER PLANT** at V.O.Chidambaranar Port Trust, Tuticorin.

Borehole No. : 3

Dia of Pile : 0.30 m

LENGTH OF PILE : 1.50 m

Coefficient (K) : 0.30

Factor of safety : 3

RL of bottom of pile cap : -RL .500 m

Depth of Soil layers from Bed Level

Description	Depths	Levels
1st Layer	0.50 m	-RL 1.000 m
2nd Layer	1.00 m	-RL 2.000 m
3rd Layer	0.00 m	-RL 2.000 m

1st Layer

Ultimate Side Resistance or Skin Friction

Type of Soil = Sand mixed with Clay

Dia of Pile = 0.30 m

Thickness of the Layer = 0.500 m

Angle of Internal friction (ϕ) = 29.0°

Average cohesion , C = 0.00 t/Sq.m

Unit weight of Soil g = 1.755 t/Cu.m

Coefficient of earth pressure (k) = 0.30

Reduction Factor a = 0.5

Surface Area (As) = 0.471 Sq.m

Average Overburden Pressure (P_{di}) = Depth of layer x Unit Weight of soil

= 0.5 x 1.755

Average Overburden Pressure (P_{di}) = 0.878 t/Sq.m

Skin Friction (Rf) = $KP_{di} \tan \phi A_{si} + (a \times C \times A_s)$

= (0.3 x 0.88 x tan 29 x 0.471) + (0.5 x 0 x 0.471)

Rf = 0.07 t

2nd Layer

Ultimate Side Resistance or Skin Friction

Type of Soil = Sand

Dia of Pile = 0.30 m

Thickness of the Layer = 1.000 m

Angle of Internal friction (ϕ) = 29.0°

Average cohesion , C = 0.00 t/Sq.m

Unit weight of Soil g = 1.759 t/Cu.m

Coefficient of earth pressure (k) = 0.30

Reduction Factor a = 0.5

Surface Area (As) = 0.942 Sq.m

Average Overburden Pressure (P_{di}) = Depth of layer x Unit Weight of soil

= 1 x 1.759

Average Overburden Pressure (P_{di}) = 2.637 t/Sq.m

Skin Friction (Rf) = $KP_{di} \tan \phi A_{si} + (a \times C \times A_s)$

= (0.3 x 2.64 x tan 29 x 0.942) + (0.5 x 0 x 0.942)

Rf = 0.41 t

Total Skin Friction = 0.48 t 4.8 kN

End Bearing Resistance

Type of Soil	=	Sand
Dia of Pile	=	0.30 m
Angle of Internal friction (ϕ)	=	29.0°
Average cohesion at pile tip (C_p)	=	0.00 t/Sq.m
Submerged unit weight of Soil γ	=	0.759 t/Cu.m
Area of Cross section(A_p)	=	0.071 Sq.m
Average Overburden Pressure (P_{av})	=	0.759 t/Sq.m
N_y	=	20.1 (From IS 6403:1981 for $\phi = 29^\circ$)
N_q	=	16.85
N_c	=	28.26
End Bearing Resistance (R_u)	=	$A_p \cdot (1/2 D \cdot \gamma \cdot N_y) + (P_{av} \cdot N_q) + (N_c \cdot C_p)$
	=	$0.071 \times (1/2 \times 0.3 \times 0.759 \times 20.1) + (0.759 \times 16.85) + 0.071 \times 28.26 \times 0$
R_u	=	12.95 t 130 kN
Q_u	=	0.482 + 12.951
Total Ultimate Pile carrying Capacity	=	13.43 t 134 kN
Allowable Pile Capacity	=	13.433 / 3
Capacity of pile, KN	=	44.78 KN

FINAL RESULT :

1	Ultimate compression Capacity	=	134 kN
2	Ultimate Pull out Capacity	=	4.8 kN
3	Factor of Safety	=	3
4	Safe compression Capacity in KN	=	44.78 KN
5	Safe Pull out Capacity in KN	=	1.61 KN



LOAD CARRYING CAPACITY OF PILES

(As per IS : 2911 (Part I / Sec 2) - 1979) APPENDIX B

Name of Project : Sub Soil Investigation for the Construction of **SOLAR POWER PLANT** at V.O.Chidambaranar Port Trust, Tuticorin.

Borehole No. : 1

Dia of Pile : 0.30 m

LENGTH OF PILE : 2.00 m

Coefficient (K) : 0.30

Factor of safety : 3

RL of bottom of pile cap : -RL .500 m

Depth of Soil layers from Bed Level

Description	Depths	Levels
1st Layer	0.50 m	-RL 1.000 m
2nd Layer	1.00 m	-RL 2.000 m
3rd Layer	0.50 m	-RL 2.500 m

1st Layer

Ultimate Side Resistance or Skin Friction

Type of Soil = Sand mixed with Clay
Dia of Pile = 0.30 m
Thickness of the Layer = 0.500 m
Angle of Internal friction (ϕ) = 29.0°
Average cohesion, C = 0.00 t/Sq.m
Unit weight of Soil, γ = 1.756 t/Cu.m
Coefficient of earth pressure (k) = 0.30
Reduction Factor a = 0.7
Surface Area (As) = 0.471 Sq.m
Average Overburden Pressure (P_{di}) = Depth of layer x Unit Weight of soil
= 0.5 x 1.756
Average Overburden Pressure (P_{di}) = 0.878 t/Sq.m
Skin Friction (Rf) = $K P_{di} \tan \phi A_{si} + (a \times C \times A_s)$
= (0.3 x 0.88 x tan 29 x 0.471) + (0.7 x 0 x 0.471)
Rf = 0.07 t

2nd Layer

Ultimate Side Resistance or Skin Friction

Type of Soil = Sand mixed with Clay
Dia of Pile = 0.30 m
Thickness of the Layer = 1.000 m
Angle of Internal friction (ϕ) = 29.0°
Average cohesion, C = 0.00 t/Sq.m
Unit weight of Soil, γ = 1.759 t/Cu.m
Coefficient of earth pressure (k) = 0.30
Reduction Factor a = 0.5
Surface Area (As) = 0.942 Sq.m
Average Overburden Pressure (P_{di}) = Depth of layer x Unit Weight of soil
= 1 x 1.759
Average Overburden Pressure (P_{di}) = 2.637 t/Sq.m
Skin Friction (Rf) = $K P_{di} \tan \phi A_{si} + (a \times C \times A_s)$
= (0.3 x 2.64 x tan 29 x 0.942) + (0.5 x 0 x 0.942)
Rf = 0.41 t

3rd Layer

Ultimate Side Resistance or Skin Friction

Type of Soil	=	Sand mixed with Clay
Dia of Pile	=	0.30 m
Thickness of the Layer	=	0.500 m
Angle of Internal friction (ϕ)	=	30.0°
Average cohesion, C	=	0.00 t/Sq.m
Unit weight of Soil, γ	=	1.763 t/Cu.m
Coefficient of earth pressure (k)	=	0.30
Reduction Factor α	=	0.4
Surface Area (A_s)	=	0.471 Sq.m
Average Overburden Pressure (P_{di})	=	Depth of layer x Unit Weight of soil
	=	0.5 x 1.763
Average Overburden Pressure (P_{di})	=	3.519 t/Sq.m
Skin Friction (R_f)	=	$K P_{di} \tan \phi A_{si} + (\alpha \times C \times A_s)$
	=	$(0.3 \times 3.52 \times \tan 30 \times 0.471) + (0.4 \times 0 \times 0.471)$
R_f	=	0.29 t
Total Skin Friction	=	0.77 t 7.7 kN

End Bearing Resistance

Type of Soil	=	Sand mixed with Clay
Dia of Pile	=	0.30 m
Angle of Internal friction (ϕ)	=	30.0°
Average cohesion at pile tip (C_p)	=	0.00 t/Sq.m
Submerged unit weight of Soil, γ	=	0.763 t/Cu.m
Area of Cross section (A_p)	=	0.071 Sq.m
Average Overburden Pressure (P_{di})	=	0.763 t/Sq.m
N_y	=	22.4 (From IS 6403:1981 for $\phi = 30^\circ$)
N_q	=	18.40
N_c	=	30.14
End Bearing Resistance (R_u)	=	$A_p \times (1/2 D \cdot \gamma \cdot N_q) + (P_{di} \cdot N_q) + (N_c \cdot C_p)$
	=	$0.071 \times (1/2 \times 0.3 \times 0.763 \times 22.4 + (0.763 \times 18.4) + 0.071 \times 30.14 \times 0)$
R_u	=	14.22 t 142 kN
QU	=	0.769 + 14.22
Total Ultimate Pile carrying Capacity	=	14.99 t 150 kN
Allowable Pile Capacity	=	14.99 / 3
Capacity of pile, KN	=	49.97 KN
		5.00 t

FINAL RESULT :

1	Ultimate compression Capacity	=	150 kN
2	Ultimate Pull out Capacity	=	7.7 kN
3	Factor of Safety	=	3
4	Safe compression Capacity in KN	=	49.97 KN
5	Safe Pull out Capacity in KN	=	2.56 KN



LOAD CARRYING CAPACITY OF PILES

(As per IS : 2911 (Part I / Sec 2) - 1979) APPENDIX B

Name of Project : Sub Soil Investigation for the Construction of **SOLAR POWER PLANT** at V.O.Chidambaranar Port Trust, Tuticorin.

Borehole No. : 2

Dia of Pile : 0.30 m

LENGTH OF PILE : 2.00 m

Coefficient (K) : 0.30

Factor of safety : 3

RL of bottom of pile cap : -RL .500 m

Depth of Soil layers from Bed Level

Description	Depths	Levels
1st Layer	0.50 m	-RL 1.000 m
2nd Layer	1.00 m	-RL 2.000 m
3rd Layer	0.50 m	-RL 2.500 m

1st Layer

Ultimate Side Resistance or Skin Friction

Type of Soil = Sand mixed with Clay
Dia of Pile = 0.30 m
Thickness of the Layer = 0.500 m
Angle of Internal friction (ϕ) = 29.0°
Average cohesion , C = 0.00 t/Sq.m
Unit weight of Soil g = 1.763 t/Cu.m
Coefficient of earth pressure (k) = 0.30
Reduction Factor a = 0.5
Surface Area (As) = 0.471 Sq.m
Average Overburden Pressure (P_{di}) = Depth of layer x Unit Weight of soil
= 0.5 x 1.763
Average Overburden Pressure (P_{di}) = 0.882 t/Sq.m
Skin Friction (Rf) = $K P_{di} \tan \phi A_{si} + (a \times C \times A_s)$
= (0.3 x 0.88 x tan 29 x 0.471) + (0.5 x 0 x 0.471)
Rf = 0.07 t

2nd Layer

Ultimate Side Resistance or Skin Friction

Type of Soil = Sand mixed with Clay
Dia of Pile = 0.30 m
Thickness of the Layer = 1.000 m
Angle of Internal friction (ϕ) = 30.0°
Average cohesion , C = 0.00 t/Sq.m
Unit weight of Soil g = 1.768 t/Cu.m
Coefficient of earth pressure (k) = 0.30
Reduction Factor a = 0.4
Surface Area (As) = 0.942 Sq.m
Average Overburden Pressure (P_{di}) = Depth of layer x Unit Weight of soil
= 1 x 1.768
Average Overburden Pressure (P_{di}) = 2.650 t/Sq.m
Skin Friction (Rf) = $K P_{di} \tan \phi A_{si} + (a \times C \times A_s)$
= (0.3 x 2.65 x tan 30 x 0.942) + (0.4 x 0 x 0.942)
Rf = 0.43 t

3rd Layer

Ultimate Side Resistance or Skin Friction

Type of Soil	=	Sand
Dia of Pile	=	0.30 m
Thickness of the Layer	=	0.500 m
Angle of Internal friction (ϕ)	=	30.0°
Average cohesion , C	=	0.00 t/Sq.m
Unit weight of Soil g	=	1.771 t/Cu.m
Coefficient of earth pressure (k)	=	0.30
Reduction Factor a	=	0.4
Surface Area (As)	=	0.471 Sq.m
Average Overburden Pressure (P_{di})	=	Depth of layer x Unit Weight of soil
	=	0.5 x 1.771
Average Overburden Pressure (P_{di})	=	3.535 t/Sq.m
Skin Friction (Rf)	=	$KP_{di} \tan \phi A_{si} + (a \times C \times A_s)$
	=	$(0.3 \times 3.54 \times \tan 30 \times 0.471) + (0.4 \times 0 \times 0.471)$
Rf	=	0.29 t
Total Skin Friction	=	0.79 t 7.9 kN

End Bearing Resistance

Type of Soil	=	Sand
Dia of Pile	=	0.30 m
Angle of Internal friction (ϕ)	=	30.0°
Average cohesion at pile tip (C_p)	=	0.00 t/Sq.m
Submerged unit weight of Soil g	=	0.763 t/Cu.m
Area of Cross section(A_p)	=	0.071 Sq.m
Average Overburden Pressure (P_{di})	=	0.763 t/Sq.m
N_y	=	22.4 (From IS 6403:1981 for $\phi = 30^\circ$)
N_q	=	18.40
N_c	=	30.14
End Bearing Resistance (Ru)	=	$A_p * (1/2 D. g .N_q) + (P_{di}.N_q) + (N_c.C_p)$
	=	$0.071 \times (1/2 \times 0.3 \times 0.763 \times 22.4 + (0.763 \times 18.4) + 0.071 \times 30.14 \times 0$
Ru	=	14.22 t 142 kN
QU	=	0.79 + 14.22
Total Ultimate Pile carrying Capacity	=	15.01 t 150 kN
Allowable Pile Capacity	=	15.011 / 3
Capacity of pile, KN	=	50.04 KN

FINAL RESULT :

1	Ultimate compression Capacity	=	150 kN
2	Ultimate Pull out Capacity	=	7.9 kN
3	Factor of Safety	=	3
4	Safe compression Capacity in KN	=	50.04 KN
5	Safe Pull out Capacity in KN	=	2.63 KN



LOAD CARRYING CAPACITY OF PILES

(As per IS : 2911 (Part I / Sec 2) - 1979) APPENDIX B

Name of Project : Sub Soil Investigation for the Construction of **SOLAR POWER PLANT** at V.O.Chidambaranar Port Trust, Tuticorin.

Borehole No. : 3

Dia of Pile : 0.30 m

LENGTH OF PILE : 2.00 m

Coefficient (K) : 0.30

Factor of safety : 3

RL of bottom of pile cap : -RL .500 m

Depth of Soil layers from Bed Level

Description	Depths	Levels
1st Layer	0.50 m	-RL 1.000 m
2nd Layer	1.00 m	-RL 2.000 m
3rd Layer	0.50 m	-RL 2.500 m

1st Layer

Ultimate Side Resistance or Skin Friction

Type of Soil = Sand mixed with Clay

Dia of Pile = 0.30 m

Thickness of the Layer = 0.500 m

Angle of Internal friction (ϕ) = 29.0°

Average cohesion , C = 0.00 t/Sq.m

Unit weight of Soil γ = 1.755 t/Cu.m

Coefficient of earth pressure (k) = 0.30

Reduction Factor a = 0.5

Surface Area (As) = 0.471 Sq.m

Average Overburden Pressure (P_{di}) = Depth of layer x Unit Weight of soil

$$= 0.5 \times 1.755$$

Average Overburden Pressure (P_{di}) = 0.878 t/Sq.m

Skin Friction (Rf) = $K P_{di} \tan \phi A_{si} + (a \times C \times A_s)$

$$= (0.3 \times 0.88 \times \tan 29 \times 0.471) + (0.5 \times 0 \times 0.471)$$

$$Rf = 0.07 \text{ t}$$

2nd Layer

Ultimate Side Resistance or Skin Friction

Type of Soil = Sand

Dia of Pile = 0.30 m

Thickness of the Layer = 1.000 m

Angle of Internal friction (ϕ) = 29.0°

Average cohesion , C = 0.00 t/Sq.m

Unit weight of Soil γ = 1.759 t/Cu.m

Coefficient of earth pressure (k) = 0.30

Reduction Factor a = 0.5

Surface Area (As) = 0.942 Sq.m

Average Overburden Pressure (P_{di}) = Depth of layer x Unit Weight of soil

$$= 1 \times 1.759$$

Average Overburden Pressure (P_{di}) = 2.637 t/Sq.m

Skin Friction (Rf) = $K P_{di} \tan \phi A_{si} + (a \times C \times A_s)$

$$= (0.3 \times 2.64 \times \tan 29 \times 0.942) + (0.5 \times 0 \times 0.942)$$

$$Rf = 0.41 \text{ t}$$

3rd Layer

Ultimate Side Resistance or Skin Friction

Type of Soil	=	Sand
Dia of Pile	=	0.30 m
Thickness of the Layer	=	0.500 m
Angle of Internal friction (ϕ)	=	29.0°
Average cohesion , C	=	0.00 t/Sq.m
Unit weight of Soil g	=	1.759 t/Cu.m
Coefficient of earth pressure (k)	=	0.30
Reduction Factor a	=	0.4
Surface Area (As)	=	0.471 Sq.m
Average Overburden Pressure (P_{di})	=	Depth of layer x Unit Weight of soil
	=	0.5 x 1.759
Average Overburden Pressure (P_{di})	=	3.516 t/Sq.m
Skin Friction (Rf)	=	$KP_{di} \tan \phi A_{si} + (a \times C \times A_s)$
	=	$(0.3 \times 3.52 \times \tan 29 \times 0.471) + (0.4 \times 0 \times 0.471)$
Rf	=	0.28 t
Total Skin Friction	=	0.76 t 7.6 kN

End Bearing Resistance

Type of Soil	=	Sand
Dia of Pile	=	0.30 m
Angle of Internal friction (ϕ)	=	29.0°
Average cohesion at pile tip (C_p)	=	0.00 t/Sq.m
Submerged unit weight of Soil g	=	0.759 t/Cu.m
Area of Cross section(A_p)	=	0.071 Sq.m
Average Overburden Pressure (P_{di})	=	0.759 t/Sq.m
N_y	=	20.1 (From IS 6403:1981 for $\phi = 29^\circ$)
N_q	=	16.85
N_c	=	28.26
End Bearing Resistance (Ru)	=	$A_p * (1/2 D. g .N_q) + (P_{di}.N_q) + (N_c.C_p)$
	=	$0.071 \times (1/2 \times 0.3 \times 0.759 \times 20.1 + (0.759 \times 16.85) + 0.071 \times 28.26 \times 0$
Ru	=	12.95 t 130 kN
QU	=	0.758 + 12.951
Total Ultimate Pile carrying Capacity	=	13.71 t 137 kN
Allowable Pile Capacity	=	13.708 / 3
Capacity of pile, KN	=	45.69 KN
		4.57 t

FINAL RESULT :

1	Ultimate compression Capacity	=	137 kN
2	Ultimate Pull out Capacity	=	7.6 kN
3	Factor of Safety	=	3
4	Safe compression Capacity in KN	=	45.69 KN
5	Safe Pull out Capacity in KN	=	2.53 KN



LOAD CARRYING CAPACITY OF PILES

(As per IS : 2911 (Part I / Sec 2) - 1979) APPENDIX B

Name of Project : Sub Soil Investigation for the Construction of **SOLAR POWER PLANT** at V.O.Chidambaranar Port Trust, Tuticorin.

Borehole No. : 1

Dia of Pile : 0.30 m

LENGTH OF PILE : 2.50 m

Coefficient (K) : 0.30

Factor of safety : 3

RL of bottom of pile cap : -RL .500 m

Depth of Soil layers from Bed Level

Description	Depths	Levels
1st Layer	0.50 m	-RL 1.000 m
2nd Layer	1.00 m	-RL 2.000 m
3rd Layer	1.00 m	-RL 3.000 m

1st Layer

Ultimate Side Resistance or Skin Friction

Type of Soil = Sand mixed with Clay
Dia of Pile = 0.30 m
Thickness of the Layer = 0.500 m
Angle of Internal friction (ϕ) = 29.0°
Average cohesion , C = 0.00 t/Sq.m
Unit weight of Soil g = 1.756 t/Cu.m
Coefficient of earth pressure (k) = 0.30
Reduction Factor a = 0.7
Surface Area (As) = 0.471 Sq.m
Average Overburden Pressure (P_{di}) = Depth of layer x Unit Weight of soil
= 0.5 x 1.756
Average Overburden Pressure (P_{di}) = 0.878 t/Sq.m
Skin Friction (Rf) = $KP_{di} \tan \phi A_{si} + (a \times C \times A_s)$
= (0.3 x 0.88 x tan 29 x 0.471) + (0.7 x 0 x 0.471)
Rf = 0.07 t

2nd Layer

Ultimate Side Resistance or Skin Friction

Type of Soil = Sand mixed with Clay
Dia of Pile = 0.30 m
Thickness of the Layer = 1.000 m
Angle of Internal friction (ϕ) = 29.0°
Average cohesion , C = 0.00 t/Sq.m
Unit weight of Soil g = 1.759 t/Cu.m
Coefficient of earth pressure (k) = 0.30
Reduction Factor a = 0.5
Surface Area (As) = 0.942 Sq.m
Average Overburden Pressure (P_{di}) = Depth of layer x Unit Weight of soil
= 1 x 1.759
Average Overburden Pressure (P_{di}) = 2.637 t/Sq.m
Skin Friction (Rf) = $KP_{di} \tan \phi A_{si} + (a \times C \times A_s)$
= (0.3 x 2.64 x tan 29 x 0.942) + (0.5 x 0 x 0.942)
Rf = 0.41 t

3rd Layer

Ultimate Side Resistance or Skin Friction

Type of Soil	=	Sand mixed with Clay
Dia of Pile	=	0.30 m
Thickness of the Layer	=	1.000 m
Angle of Internal friction (ϕ)	=	30.0°
Average cohesion , C	=	0.00 t/Sq.m
Unit weight of Soil g	=	1.763 t/Cu.m
Coefficient of earth pressure (k)	=	0.30
Reduction Factor a	=	0.4
Surface Area (As)	=	0.942 Sq.m
Average Overburden Pressure (P_{di})	=	Depth of layer x Unit Weight of soil
	=	1 x 1.763
Average Overburden Pressure (P_{di})	=	4.400 t/Sq.m
Skin Friction (Rf)	=	$KP_{di} \tan \phi A_{si} + (a \times C \times A_s)$
	=	$(0.3 \times 4.4 \times \tan 30 \times 0.942) + (0.4 \times 0 \times 0.942)$
Rf	=	0.72 t
Total Skin Friction	=	1.20 t 12.0 kN

End Bearing Resistance

Type of Soil	=	Sand mixed with Clay
Dia of Pile	=	0.30 m
Angle of Internal friction (ϕ)	=	30.0°
Average cohesion at pile tip (C_p)	=	0.00 t/Sq.m
Submerged unit weight of Soil g	=	0.765 t/Cu.m
Area of Cross section(A_p)	=	0.071 Sq.m
Average Overburden Pressure (P_{di})	=	0.765 t/Sq.m
N_y	=	22.4 (From IS 6403:1981 for $\phi = 30^\circ$)
N_q	=	18.40
N_c	=	30.14
End Bearing Resistance (Ru)	=	$A_p * (1/2 D. g .N_q) + (P_{di}.N_q) + (N_c.C_p)$
	=	$0.071 \times (1/2 \times 0.3 \times 0.765 \times 22.4 + (0.765 \times 18.4) + 0.071 \times 30.14 \times 0$
Ru	=	14.26 t 143 kN
QU	=	1.2 + 14.258
Total Ultimate Pile carrying Capacity	=	15.46 t 155 kN
Allowable Pile Capacity	=	15.458 / 3
Capacity of pile, KN	=	5.153 KN

FINAL RESULT :

1	Ultimate compression Capacity	=	155 kN
2	Ultimate Pull out Capacity	=	12.0 kN
3	Factor of Safety	=	3
4	Safe compression Capacity in KN	=	51.53 KN
5	Safe Pull out Capacity in KN	=	4.00 KN



LOAD CARRYING CAPACITY OF PILES

(As per IS : 2911 (Part I / Sec 2) - 1979) APPENDIX B

Name of Project : Sub Soil Investigation for the Construction of **SOLAR POWER PLANT** at V.O.Chidambaranar Port Trust, Tuticorin.

Borehole No. : 2

Dia of Pile : 0.30 m

LENGTH OF PILE : 2.50 m

Coefficient (K) : 0.30

Factor of safety : 3

RL of bottom of pile cap : -RL .500 m

Depth of Soil layers from Bed Level

Description	Depths	Levels
1st Layer	0.50 m	-RL 1.000 m
2nd Layer	1.00 m	-RL 2.000 m
3rd Layer	1.00 m	-RL 3.000 m

1st Layer

Ultimate Side Resistance or Skin Friction

Type of Soil = Sand mixed with Clay
Dia of Pile = 0.30 m
Thickness of the Layer = 0.500 m
Angle of Internal friction (ϕ) = 29.0°
Average cohesion , C = 0.00 t/Sq.m
Unit weight of Soil g = 1.763 t/Cu.m
Coefficient of earth pressure (k) = 0.30
Reduction Factor a = 0.5
Surface Area (As) = 0.471 Sq.m
Average Overburden Pressure (P_{di}) = Depth of layer x Unit Weight of soil
= 0.5 x 1.763
Average Overburden Pressure (P_{di}) = 0.882 t/Sq.m
Skin Friction (Rf) = $KP_{di} \tan \phi A_{si} + (a \times C \times A_s)$
= (0.3 x 0.88 x tan 29 x 0.471) + (0.5 x 0 x 0.471)
Rf = 0.07 t

2nd Layer

Ultimate Side Resistance or Skin Friction

Type of Soil = Sand mixed with Clay
Dia of Pile = 0.30 m
Thickness of the Layer = 1.000 m
Angle of Internal friction (ϕ) = 30.0°
Average cohesion , C = 0.00 t/Sq.m
Unit weight of Soil g = 1.768 t/Cu.m
Coefficient of earth pressure (k) = 0.30
Reduction Factor a = 0.4
Surface Area (As) = 0.942 Sq.m
Average Overburden Pressure (P_{di}) = Depth of layer x Unit Weight of soil
= 1 x 1.768
Average Overburden Pressure (P_{di}) = 2.650 t/Sq.m
Skin Friction (Rf) = $KP_{di} \tan \phi A_{si} + (a \times C \times A_s)$
= (0.3 x 2.65 x tan 30 x 0.942) + (0.4 x 0 x 0.942)
Rf = 0.43 t

3rd Layer

Ultimate Side Resistance or Skin Friction

Type of Soil	=	Sand
Dia of Pile	=	0.30 m
Thickness of the Layer	=	1.000 m
Angle of Internal friction (ϕ)	=	30.0°
Average cohesion , C	=	0.00 t/Sq.m
Unit weight of Soil g	=	1.771 t/Cu.m
Coefficient of earth pressure (k)	=	0.30
Reduction Factor a	=	0.4
Surface Area (As)	=	0.942 Sq.m
Average Overburden Pressure (P_{di})	=	Depth of layer x Unit Weight of soil
	=	1 x 1.771
Average Overburden Pressure (P_{di})	=	4.421 t/Sq.m
Skin Friction (Rf)	=	$KP_{di} \tan \phi A_{si} + (a \times C \times A_s)$
	=	$(0.3 \times 4.42 \times \tan 30 \times 0.942) + (0.4 \times 0 \times 0.942)$
Rf	=	0.72 t
Total Skin Friction	=	1.22 t 12.2 kN

End Bearing Resistance

Type of Soil	=	Sand mixed with Clay
Dia of Pile	=	0.30 m
Angle of Internal friction (ϕ)	=	30.0°
Average cohesion at pile tip (C_p)	=	0.00 t/Sq.m
Submerged unit weight of Soil g	=	0.775 t/Cu.m
Area of Cross section(A_p)	=	0.071 Sq.m
Average Overburden Pressure (P_{di})	=	0.775 t/Sq.m
N_y	=	22.4 (From IS 6403:1981 for $\phi = 30^\circ$)
N_q	=	18.40
N_c	=	30.14
End Bearing Resistance (R_u)	=	$A_p * (1/2 D. g .N_q) + (P_{di}.N_q) + (N_c.C_p)$
	=	$0.071 \times (1/2 \times 0.3 \times 0.775 \times 22.4 + (0.775 \times 18.4) + 0.071 \times 30.14 \times 0$
R_u	=	14.44 t 144 kN
QU	=	1.223 + 14.444
Total Ultimate Pile carrying Capacity	=	15.67 t 157 kN
Allowable Pile Capacity	=	15.667 / 3
Capacity of pile, KN	=	5.22 KN

FINAL RESULT :

1	Ultimate compression Capacity	=	157 kN
2	Ultimate Pull out Capacity	=	12.2 kN
3	Factor of Safety	=	3
4	Safe compression Capacity in KN	=	52.22 KN
5	Safe Pull out Capacity in KN	=	4.08 KN



LOAD CARRYING CAPACITY OF PILES

(As per IS : 2911 (Part I / Sec 2) - 1979) APPENDIX B

Name of Project : Sub Soil Investigation for the Construction of **SOLAR POWER PLANT** at V.O.Chidambaranar Port Trust, Tuticorin.

Borehole No. : 3

Dia of Pile : 0.30 m

LENGTH OF PILE : 2.50 m

Coefficient (K) : 0.30

Factor of safety : 3

RL of bottom of pile cap : -RL .500 m

Depth of Soil layers from Bed Level

Description	Depths	Levels
1st Layer	0.50 m	-RL 1.000 m
2nd Layer	1.00 m	-RL 2.000 m
3rd Layer	1.00 m	-RL 3.000 m

1st Layer

Ultimate Side Resistance or Skin Friction

Type of Soil = Sand mixed with Clay

Dia of Pile = 0.30 m

Thickness of the Layer = 0.500 m

Angle of Internal friction (ϕ) = 29.0°

Average cohesion , C = 0.00 t/Sq.m

Unit weight of Soil γ = 1.755 t/Cu.m

Coefficient of earth pressure (k) = 0.30

Reduction Factor a = 0.5

Surface Area (As) = 0.471 Sq.m

Average Overburden Pressure (P_{di}) = Depth of layer x Unit Weight of soil

$$= 0.5 \times 1.755$$

Average Overburden Pressure (P_{di}) = 0.878 t/Sq.m

Skin Friction (Rf) = $KP_{di} \tan \phi A_{si} + (a \times C \times A_s)$

$$= (0.3 \times 0.88 \times \tan 29 \times 0.471) + (0.5 \times 0 \times 0.471)$$

$$Rf = 0.07 \text{ t}$$

2nd Layer

Ultimate Side Resistance or Skin Friction

Type of Soil = Sand

Dia of Pile = 0.30 m

Thickness of the Layer = 1.000 m

Angle of Internal friction (ϕ) = 29.0°

Average cohesion , C = 0.00 t/Sq.m

Unit weight of Soil γ = 1.759 t/Cu.m

Coefficient of earth pressure (k) = 0.30

Reduction Factor a = 0.5

Surface Area (As) = 0.942 Sq.m

Average Overburden Pressure (P_{di}) = Depth of layer x Unit Weight of soil

$$= 1 \times 1.759$$

Average Overburden Pressure (P_{di}) = 2.637 t/Sq.m

Skin Friction (Rf) = $KP_{di} \tan \phi A_{si} + (a \times C \times A_s)$

$$= (0.3 \times 2.64 \times \tan 29 \times 0.942) + (0.5 \times 0 \times 0.942)$$

$$Rf = 0.41 \text{ t}$$

3rd Layer

Ultimate Side Resistance or Skin Friction

Type of Soil	=	Sand
Dia of Pile	=	0.30 m
Thickness of the Layer	=	1.000 m
Angle of Internal friction (ϕ)	=	29.0°
Average cohesion , C	=	0.00 t/Sq.m
Unit weight of Soil g	=	1.759 t/Cu.m
Coefficient of earth pressure (k)	=	0.30
Reduction Factor a	=	0.4
Surface Area (As)	=	0.942 Sq.m
Average Overburden Pressure (P_{di})	=	Depth of layer x Unit Weight of soil
	=	1 x 1.759
Average Overburden Pressure (P_{di})	=	4.396 t/Sq.m
Skin Friction (Rf)	=	$KP_{di} \tan \phi A_{si} + (a \times C \times A_s)$
	=	$(0.3 \times 4.4 \times \tan 29 \times 0.942) + (0.4 \times 0 \times 0.942)$
Rf	=	0.69 t
Total Skin Friction	=	1.17 t 11.7 kN

End Bearing Resistance

Type of Soil	=	Sand
Dia of Pile	=	0.30 m
Angle of Internal friction (ϕ)	=	30.0°
Average cohesion at pile tip (C_p)	=	0.00 t/Sq.m
Submerged unit weight of Soil g	=	0.760 t/Cu.m
Area of Cross section(A_p)	=	0.071 Sq.m
Average Overburden Pressure (P_{di})	=	0.760 t/Sq.m
N_y	=	22.4 (From IS 6403:1981 for $\phi = 30^\circ$)
N_q	=	18.40
N_c	=	30.14
End Bearing Resistance (R_u)	=	$A_p * (1/2 D. g .N_q) + (P_{di}.N_q) + (N_c.C_p)$
	=	$0.071 \times (1/2 \times 0.3 \times 0.76 \times 22.4 + (0.76 \times 18.4) + 0.071 \times 30.14 \times 0$
R_u	=	14.16 t 142 kN
QU	=	1.171 + 14.165
Total Ultimate Pile carrying Capacity	=	15.34 t 153 kN
Allowable Pile Capacity	=	15.335 / 3
Capacity of pile, KN	=	5.11 t
Capacity of pile, KN	=	51.12 KN

FINAL RESULT :

1	Ultimate compression Capacity	=	153 kN
2	Ultimate Pull out Capacity	=	11.7 kN
3	Factor of Safety	=	3
4	Safe compression Capacity in KN	=	51.12 KN
5	Safe Pull out Capacity in KN	=	3.90 KN



LOAD CARRYING CAPACITY OF PILES

(As per IS : 2911 (Part I / Sec 2) - 1979) APPENDIX B

Name of Project : Sub Soil Investigation for the Construction of **SOLAR POWER PLANT** at V.O.Chidambaranar Port Trust, Tuticorin.

Borehole No. : 1

Dia of Pile : 0.30 m

LENGTH OF PILE : 3.00 m

Coefficient (K) : 0.30

Factor of safety : 3

RL of bottom of pile cap : -RL .500 m

Depth of Soil layers from Bed Level

Description	Depths	Levels
1st Layer	0.50 m	-RL 1.000 m
2nd Layer	1.00 m	-RL 2.000 m
3rd Layer	1.00 m	-RL 3.000 m
4th Layer	0.50 m	-RL 3.500 m

1st Layer

Ultimate Side Resistance or Skin Friction

Type of Soil = Sand mixed with Clay
Dia of Pile = 0.30 m
Thickness of the Layer = 0.500 m
Angle of Internal friction (ϕ) = 29.0°
Average cohesion , C = 0.00 t/Sq.m
Unit weight of Soil g = 1.756 t/Cu.m
Coefficient of earth pressure (k) = 0.30
Reduction Factor a = 0.7
Surface Area (As) = 0.471 Sq.m
Average Overburden Pressure (P_{di}) = Depth of layer x Unit Weight of soil
= 0.5 x 1.756
Average Overburden Pressure (P_{di}) = 0.878 t/Sq.m
Skin Friction (Rf) = $KP_{di} \tan \phi A_{si} + (a \times C \times A_s)$
= $(0.3 \times 0.88 \times \tan 29 \times 0.471) + (0.7 \times 0 \times 0.471)$
Rf = 0.07 t

2nd Layer

Ultimate Side Resistance or Skin Friction

Type of Soil = Sand mixed with Clay
Dia of Pile = 0.30 m
Thickness of the Layer = 1.000 m
Angle of Internal friction (ϕ) = 29.0°
Average cohesion , C = 0.00 t/Sq.m
Unit weight of Soil g = 1.759 t/Cu.m
Coefficient of earth pressure (k) = 0.30
Reduction Factor a = 0.5
Surface Area (As) = 0.942 Sq.m
Average Overburden Pressure (P_{di}) = Depth of layer x Unit Weight of soil
= 1 x 1.759
Average Overburden Pressure (P_{di}) = 2.637 t/Sq.m
Skin Friction (Rf) = $KP_{di} \tan \phi A_{si} + (a \times C \times A_s)$
= $(0.3 \times 2.64 \times \tan 29 \times 0.942) + (0.5 \times 0 \times 0.942)$
Rf = 0.41 t

3rd Layer

Ultimate Side Resistance or Skin Friction

Type of Soil	=	Sand mixed with Clay
Dia of Pile	=	0.30 m
Thickness of the Layer	=	1.000 m
Angle of Internal friction (ϕ)	=	30.0°
Average cohesion , C	=	0.00 t/Sq.m
Unit weight of Soil g	=	1.763 t/Cu.m
Coefficient of earth pressure (k)	=	0.30
Reduction Factor a	=	0.4
Surface Area (As)	=	0.942 Sq.m
Average Overburden Pressure (P_{di})	=	Depth of layer x Unit Weight of soil
	=	1 x 1.763
Average Overburden Pressure (P_{di})	=	4.400 t/Sq.m
Skin Friction (Rf)	=	$KP_{di} \tan \phi A_{si} + (a \times C \times A_s)$
	=	$(0.3 \times 4.4 \times \tan 30 \times 0.942) + (0.4 \times 0 \times 0.942)$
Rf	=	0.72 t

4th Layer

Ultimate Side Resistance or Skin Friction

Type of Soil	=	Sand mixed with Clay
Dia of Pile	=	0.30 m
Thickness of the Layer	=	0.500 m
Angle of Internal friction (ϕ)	=	30.0°
Average cohesion , C	=	0.00 t/Sq.m
Unit weight of Soil g	=	1.765 t/Cu.m
Coefficient of earth pressure (k)	=	0.30
Reduction Factor a	=	0.4
Surface Area (As)	=	0.471 Sq.m
Average Overburden Pressure (P_{di})	=	Depth of layer x Unit Weight of soil
	=	0.5 x 1.765
Average Overburden Pressure (P_{di})	=	5.283 t/Sq.m
Skin Friction (Rf)	=	$KP_{di} \tan \phi A_{si} + (a \times C \times A_s)$
	=	$(0.3 \times 5.28 \times \tan 30 \times 0.471) + (0.4 \times 0 \times 0.471)$
Rf	=	0.43 t
Total Skin Friction	=	1.63 t 16.3 kN

End Bearing Resistance

Type of Soil	=	Sand mixed with Clay
Dia of Pile	=	0.30 m
Angle of Internal friction (ϕ)	=	30.0°
Average cohesion at pile tip (C_p)	=	0.00 t/Sq.m
Submerged unit weight of Soil g	=	0.765 t/Cu.m
Area of Cross section(A_p)	=	0.071 Sq.m
Average Overburden Pressure (P_{di})	=	0.765 t/Sq.m
N_y	=	22.4 (From IS 6403:1981 for $\phi = 30^\circ$)
N_q	=	18.40
N_c	=	30.14
End Bearing Resistance (Ru)	=	$A_p * (1/2 D. g .N_y) + (P_{di}.N_q) + (N_c.C_p)$
	=	$0.071 \times (1/2 \times 0.3 \times 0.765 \times 22.4 + (0.765 \times 18.4) + 0.071 \times 30.14 \times 0)$
Ru	=	14.26 t 143 kN
QU	=	1.632 + 14.258
Total Ultimate Pile carrying Capacity	=	15.89 t 159 kN
Allowable Pile Capacity	=	15.889 / 3
Capacity of pile, KN	=	52.96 KN
		5.30 t

FINAL RESULT :

1	Ultimate compression Capacity	=	159 kN
2	Ultimate Pull out Capacity	=	16.3 kN
3	Factor of Safety	=	3
4	Safe compression Capacity in KN	=	52.96 KN
5	Safe Pull out Capacity in KN	=	5.44 KN



LOAD CARRYING CAPACITY OF PILES

(As per IS : 2911 (Part I / Sec 2) - 1979) APPENDIX B

Name of Project : Sub Soil Investigation for the Construction of **SOLAR POWER PLANT** at V.O.Chidambaranar Port Trust, Tuticorin.

Borehole No. : 2

Dia of Pile : 0.30 m

LENGTH OF PILE : 3.00 m

Coefficient (K) : 0.30

Factor of safety : 3

RL of bottom of pile cap : -RL .500 m

Depth of Soil layers from Bed Level

Description	Depths	Levels
1st Layer	0.50 m	-RL 1.000 m
2nd Layer	1.00 m	-RL 2.000 m
3rd Layer	1.00 m	-RL 3.000 m
4th Layer	0.50 m	-RL 3.500 m

1st Layer

Ultimate Side Resistance or Skin Friction

Type of Soil = Sand mixed with Clay
Dia of Pile = 0.30 m
Thickness of the Layer = 0.500 m
Angle of Internal friction (ϕ) = 29.0°
Average cohesion , C = 0.00 t/Sq.m
Unit weight of Soil g = 1.763 t/Cu.m
Coefficient of earth pressure (k) = 0.30
Reduction Factor a = 0.5
Surface Area (As) = 0.471 Sq.m
Average Overburden Pressure (P_{di}) = Depth of layer x Unit Weight of soil
= 0.5 x 1.763
Average Overburden Pressure (P_{di}) = 0.882 t/Sq.m
Skin Friction (Rf) = $KP_{di} \tan \phi A_{si} + (a \times C \times A_s)$
= $(0.3 \times 0.88 \times \tan 29 \times 0.471) + (0.5 \times 0 \times 0.471)$
Rf = 0.07 t

2nd Layer

Ultimate Side Resistance or Skin Friction

Type of Soil = Sand mixed with Clay
Dia of Pile = 0.30 m
Thickness of the Layer = 1.000 m
Angle of Internal friction (ϕ) = 30.0°
Average cohesion , C = 0.00 t/Sq.m
Unit weight of Soil g = 1.768 t/Cu.m
Coefficient of earth pressure (k) = 0.30
Reduction Factor a = 0.4
Surface Area (As) = 0.942 Sq.m
Average Overburden Pressure (P_{di}) = Depth of layer x Unit Weight of soil
= 1 x 1.768
Average Overburden Pressure (P_{di}) = 2.650 t/Sq.m
Skin Friction (Rf) = $KP_{di} \tan \phi A_{si} + (a \times C \times A_s)$
= $(0.3 \times 2.65 \times \tan 30 \times 0.942) + (0.4 \times 0 \times 0.942)$
Rf = 0.43 t

3rd Layer

Ultimate Side Resistance or Skin Friction

Type of Soil	=	Sand
Dia of Pile	=	0.30 m
Thickness of the Layer	=	1.000 m
Angle of Internal friction (ϕ)	=	30.0°
Average cohesion , C	=	0.00 t/Sq.m
Unit weight of Soil g	=	1.771 t/Cu.m
Coefficient of earth pressure (k)	=	0.30
Reduction Factor a	=	0.4
Surface Area (As)	=	0.942 Sq.m
Average Overburden Pressure (P_{di})	=	Depth of layer x Unit Weight of soil
	=	1 x 1.771
Average Overburden Pressure (P_{di})	=	4.421 t/Sq.m
Skin Friction (Rf)	=	$KP_{di} \tan \phi A_{si} + (a \times C \times A_s)$
	=	$(0.3 \times 4.42 \times \tan 30 \times 0.942) + (0.4 \times 0 \times 0.942)$
Rf	=	0.72 t

4th Layer

Ultimate Side Resistance or Skin Friction

Type of Soil	=	Sand mixed with Clay
Dia of Pile	=	0.30 m
Thickness of the Layer	=	0.500 m
Angle of Internal friction (ϕ)	=	30.0°
Average cohesion , C	=	0.00 t/Sq.m
Unit weight of Soil g	=	1.775 t/Cu.m
Coefficient of earth pressure (k)	=	0.30
Reduction Factor a	=	0.4
Surface Area (As)	=	0.471 Sq.m
Average Overburden Pressure (P_{di})	=	Depth of layer x Unit Weight of soil
	=	0.5 x 1.775
Average Overburden Pressure (P_{di})	=	5.308 t/Sq.m
Skin Friction (Rf)	=	$KP_{di} \tan \phi A_{si} + (a \times C \times A_s)$
	=	$(0.3 \times 5.31 \times \tan 30 \times 0.471) + (0.4 \times 0 \times 0.471)$
Rf	=	0.43 t
Total Skin Friction	=	1.66 t 16.6 kN

End Bearing Resistance

Type of Soil	=	Sand mixed with Clay
Dia of Pile	=	0.30 m
Angle of Internal friction (ϕ)	=	30.0°
Average cohesion at pile tip (C_p)	=	0.00 t/Sq.m
Submerged unit weight of Soil g	=	0.775 t/Cu.m
Area of Cross section(A_p)	=	0.071 Sq.m
Average Overburden Pressure (P_{di})	=	0.775 t/Sq.m
N_y	=	22.4 (From IS 6403:1981 for $\phi = 30^\circ$)
N_q	=	18.40
N_c	=	30.14
End Bearing Resistance (Ru)	=	$A_p * (1/2 D. g .N_q) + (P_{di}.N_q) + (N_c.C_p)$
	=	$0.071 \times (1/2 \times 0.3 \times 0.775 \times 22.4 + (0.775 \times 18.4) + 0.071 \times 30.14 \times 0)$
Ru	=	14.44 t 144 kN
QU	=	1.656 + 14.444
Total Ultimate Pile carrying Capacity	=	16.10 t 161 kN
Allowable Pile Capacity	=	16.101 / 3
Capacity of pile, KN	=	53.67 KN

FINAL RESULT :

1	Ultimate compression Capacity	=	161 kN
2	Ultimate Pull out Capacity	=	16.6 kN
3	Factor of Safety	=	3
4	Safe compression Capacity in KN	=	53.67 KN
5	Safe Pull out Capacity in KN	=	5.52 KN



LOAD CARRYING CAPACITY OF PILES

(As per IS : 2911 (Part I / Sec 2) - 1979) APPENDIX B

Name of Project : Sub Soil Investigation for the Construction of **SOLAR POWER PLANT** at V.O.Chidambaranar Port Trust, Tuticorin.

Borehole No. : 3

Dia of Pile : 0.30 m

LENGTH OF PILE : 3.00 m

Coefficient (K) : 0.30

Factor of safety : 3

RL of bottom of pile cap : -RL .500 m

Depth of Soil layers from Bed Level

Description	Depths	Levels
1st Layer	0.50 m	-RL 1.000 m
2nd Layer	1.00 m	-RL 2.000 m
3rd Layer	1.00 m	-RL 3.000 m
4th Layer	0.50 m	-RL 3.500 m

1st Layer

Ultimate Side Resistance or Skin Friction

Type of Soil = Sand mixed with Clay
Dia of Pile = 0.30 m
Thickness of the Layer = 0.500 m
Angle of Internal friction (ϕ) = 29.0°
Average cohesion , C = 0.00 t/Sq.m
Unit weight of Soil g = 1.755 t/Cu.m
Coefficient of earth pressure (k) = 0.30
Reduction Factor a = 0.5
Surface Area (As) = 0.471 Sq.m
Average Overburden Pressure (P_{di}) = Depth of layer x Unit Weight of soil
= 0.5 x 1.755
Average Overburden Pressure (P_{di}) = 0.878 t/Sq.m
Skin Friction (Rf) = $KP_{di} \tan \phi A_{si} + (a \times C \times A_s)$
= $(0.3 \times 0.88 \times \tan 29 \times 0.471) + (0.5 \times 0 \times 0.471)$
Rf = 0.07 t

2nd Layer

Ultimate Side Resistance or Skin Friction

Type of Soil = Sand
Dia of Pile = 0.30 m
Thickness of the Layer = 1.000 m
Angle of Internal friction (ϕ) = 29.0°
Average cohesion , C = 0.00 t/Sq.m
Unit weight of Soil g = 1.759 t/Cu.m
Coefficient of earth pressure (k) = 0.30
Reduction Factor a = 0.5
Surface Area (As) = 0.942 Sq.m
Average Overburden Pressure (P_{di}) = Depth of layer x Unit Weight of soil
= 1 x 1.759
Average Overburden Pressure (P_{di}) = 2.637 t/Sq.m
Skin Friction (Rf) = $KP_{di} \tan \phi A_{si} + (a \times C \times A_s)$
= $(0.3 \times 2.64 \times \tan 29 \times 0.942) + (0.5 \times 0 \times 0.942)$
Rf = 0.41 t

3rd Layer

Ultimate Side Resistance or Skin Friction

Type of Soil	=	Sand
Dia of Pile	=	0.30 m
Thickness of the Layer	=	1.000 m
Angle of Internal friction (ϕ)	=	29.0°
Average cohesion , C	=	0.00 t/Sq.m
Unit weight of Soil g	=	1.759 t/Cu.m
Coefficient of earth pressure (k)	=	0.30
Reduction Factor a	=	0.4
Surface Area (As)	=	0.942 Sq.m
Average Overburden Pressure (P_{di})	=	Depth of layer x Unit Weight of soil
	=	1 x 1.759
Average Overburden Pressure (P_{di})	=	4.396 t/Sq.m
Skin Friction (Rf)	=	$KP_{di} \tan \phi A_{si} + (a \times C \times A_s)$
	=	$(0.3 \times 4.4 \times \tan 29 \times 0.942) + (0.4 \times 0 \times 0.942)$
Rf	=	0.69 t

4th Layer

Ultimate Side Resistance or Skin Friction

Type of Soil	=	Sand
Dia of Pile	=	0.30 m
Thickness of the Layer	=	0.500 m
Angle of Internal friction (ϕ)	=	30.0°
Average cohesion , C	=	0.00 t/Sq.m
Unit weight of Soil g	=	1.760 t/Cu.m
Coefficient of earth pressure (k)	=	0.30
Reduction Factor a	=	0.4
Surface Area (As)	=	0.471 Sq.m
Average Overburden Pressure (P_{di})	=	Depth of layer x Unit Weight of soil
	=	0.5 x 1.76
Average Overburden Pressure (P_{di})	=	5.276 t/Sq.m
Skin Friction (Rf)	=	$KP_{di} \tan \phi A_{si} + (a \times C \times A_s)$
	=	$(0.3 \times 5.28 \times \tan 30 \times 0.471) + (0.4 \times 0 \times 0.471)$
Rf	=	0.43 t
Total Skin Friction	=	1.60 t 16.0 kN

End Bearing Resistance

Type of Soil	=	Sand
Dia of Pile	=	0.30 m
Angle of Internal friction (ϕ)	=	30.0°
Average cohesion at pile tip (C_p)	=	0.00 t/Sq.m
Submerged unit weight of Soil g	=	0.760 t/Cu.m
Area of Cross section(A_p)	=	0.071 Sq.m
Average Overburden Pressure (P_{di})	=	0.760 t/Sq.m
N_y	=	22.4 (From IS 6403:1981 for $\phi = 30^\circ$)
N_q	=	18.40
N_c	=	30.14
End Bearing Resistance (Ru)	=	$A_p * (1/2 D. g .N_y) + (P_{di}.N_q) + (N_c.C_p)$
	=	$0.071 \times (1/2 \times 0.3 \times 0.76 \times 22.4 + (0.76 \times 18.4) + 0.071 \times 30.14 \times 0)$
Ru	=	14.16 t 142 kN
QU	=	1.601 + 14.165
Total Ultimate Pile carrying Capacity	=	15.77 t 158 kN
Allowable Pile Capacity	=	15.766 / 3
Capacity of pile, KN	=	52.55 KN

FINAL RESULT :

1	Ultimate compression Capacity	=	158 kN
2	Ultimate Pull out Capacity	=	16.0 kN
3	Factor of Safety	=	3
4	Safe compression Capacity in KN	=	52.55 KN
5	Safe Pull out Capacity in KN	=	5.34 KN

**GEOMATRIX CONSULTANCY**

Geo-Tech. Consultants & Engineers

Name of Project : Sub Soil Investigation for the Construction of **SOLAR POWER PLANT** at
V.O.Chidambaranar Port Trust, Tuticorin.

REPORT NO : 131A/ GMC 17-18

BH No : 1

CALCULATION - 6

SAFE BEARING CAPACITY CALCULATIONS on SHALLOW FOUNDATIONS**TYPE OF FOOTING : SQUARE FOOTING**

Breadth of footing	(Assumed value)	B =	1.50 m
Foundation depth		D _f =	3.00 m
Correction Factor for Water Table		W' =	0.50
Unit weight of soil		γ _{soil} =	1.765 T/m ³
Cohension		"C" =	0.00 T/m ²
Angle of shearing resistance(general shear)	φ =		30.00°
Angle of shearing resistance(Local shear)	φ' =		21.02° (Tan ⁻¹ (2/3 * tanφ)
Safety factor		F =	2.50
Effective Surcharge of Soil above Footing Base		q =	2.30 T/m ²
Type of soil			= Medium Consolidated Sand
Mode of failure			= Combined (GSF & LSF) Shear Failure
Ground Water Table level (Assumed for worst Case - at the Ground level) =			0 m From NGL

The Bearing Capacity Factors are Given by the following equations

For GENERAL SHEAR FAILURE

$$N_q = \tan^2 (45^\circ + \phi') (e^{\pi \tan \phi'}) = 18.401$$

$$N_c = (N_q - 1) \cot \phi' = 30.139$$

$$N_\gamma = 2 (N_q + 1) \tan \phi' = 22.402$$

For LOCAL SHEAR FAILURE

$$N'_q = \tan^2 (45^\circ + \phi') (e^{\pi \tan \phi'}) = 7.085$$

$$N'_c = (N_q - 1) \cot \phi' = 15.835$$

$$N'_\gamma = 2 (N_q + 1) \tan \phi' = 6.214$$

The Shape Factors

Shape of Footing	S_c	S_q	S_γ
CONTINUOUS STRIP FOOTING	1.0	1.0	1.0
SQUARE FOOTING	1.3	1.2	0.8
RECTANGULAR FOOTING	$1+0.2B/L$	$1+0.2B/L$	$1-0.4B/L$

SQUARE FOOTING	
$S_c =$	1.300
$S_q =$	1.200
$S_\gamma =$	0.800

The Depth Factor

$d_c =$	$1 + 0.2 D_f / B \times \tan (45^\circ + \phi'/2) =$	1.693
$d_q = d_\gamma =$	1 for $\phi' < 10^\circ$	1.000
$d_q = d_\gamma =$	$1 + 0.1 D_f / B \tan(45^\circ + \phi'/2)$ for $\phi' > 10^\circ =$	1.346

The Inclination Factor

$i_c = i_q =$	$1 - \alpha / 90$	$1 - \alpha / \phi'$
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α = Inclination of the load to the vertical in degree =

$$\begin{aligned} \text{Net Ultimate Bearing Capacity, } q_d = & (c N_c S_c d_c i_c) + (q \times (N_q - 1) \times S_q d_q i_q) + \\ & (0.5 \times B \times \gamma \times N_\gamma \times S_\gamma d_\gamma i_\gamma W') + (2/3) (c N' c \times S_c d_c i_c) + (q \times (N' q - 1) \times S_q d_q i_q) + (0.5 \times B \times \gamma \times N' \gamma \times S_\gamma d_\gamma i_\gamma W') \\ & = 53.73 \quad \text{T/sq.m} \end{aligned}$$

SAFE BEARING CAPACITY :

$$SBC = q_d / F.s = \quad \quad \quad \mathbf{21.49 \text{ T/sq.m}} \quad \quad \quad \text{or} \quad \quad \quad \mathbf{210.83 \text{ kN/m}^2}$$

SETTLEMENT CALCULATIONS AS PER IS-8009-(part-1) 1998

Q_s = Pressure, S_i = Immediate settlement I = Influence factor

B = width of foundation μ = Poisson's ratio E_s = Elastic Modulus

For,

Medium Consolidated Sand

$$E = 1200(N+6)$$

$$E_s = 20400 \text{ kN/m}^2$$

$$(or) E_s = 2040.00 \text{ t/m}^2$$

$$S_i = 0.0113 \text{ m}$$

$$0.0113 \times 1000$$

$$\text{Settlement} = \quad \quad \quad \mathbf{11 \text{ mm}} < \mathbf{50 \text{ mm}} \quad \quad \quad \mathbf{Hence SAFE}$$

The Max Allowable Differential Settlement for **Sand & Gravel** is **50mm** and for **Silt & Clay** is **75mm**.

**GEOMATRIX CONSULTANCY**

Geo-Tech. Consultants & Engineers

Name of Project : **Sub Soil Investigation for the Construction of SOLAR POWER PLANT at V.O.Chidambaranar Port Trust, Tuticorin.**

REPORT NO : 131A/ GMC 17-18

BH No : 2

CALCULATION - 7

SAFE BEARING CAPACITY CALCULATIONS on SHALLOW FOUNDATIONS**TYPE OF FOOTING : SQUARE FOOTING**

Breadth of footing	(Assumed value)	B =	1.50 m
Foundation depth		D _f =	3.00 m
Correction Factor for Water Table		W' =	0.50
Unit weight of soil		γ _{soil} =	1.775 T/m³
Cohension		"C" =	0.00 T/m²
Angle of shearing resistance(general shear)	φ =		30.00°
Angle of shearing resistance(Local shear)	φ' =		21.02° (Tan⁻¹ (2/3 * tanφ)
Safety factor		F =	2.50
Effective Surcharge of Soil above Footing Base		q =	2.33 T/m²
Type of soil			= Medium Consolidated Sand
Mode of failure			= Combined (GSF & LSF) Shear Failure
Ground Water Table level (Assumed for worst Case - at the Ground level) =			0 m From NGL

The Bearing Capacity Factors are Given by the following equations

For GENERAL SHEAR FAILURE

$$N_q = \tan^2 (45^\circ + \phi') (e^{\pi \tan \phi'}) = 18.401$$

$$N_c = (N_q - 1) \cot \phi' = 30.139$$

$$N_\gamma = 2 (N_q + 1) \tan \phi' = 22.402$$

For LOCAL SHEAR FAILURE

$$N'_q = \tan^2 (45^\circ + \phi') (e^{\pi \tan \phi'}) = 7.085$$

$$N'_c = (N_q - 1) \cot \phi' = 15.835$$

$$N'_\gamma = 2 (N_q + 1) \tan \phi' = 6.214$$

The Shape Factors

Shape of Footing	S_c	S_q	S_γ
CONTINUOUS STRIP FOOTING	1.0	1.0	1.0
SQUARE FOOTING	1.3	1.2	0.8
RECTANGULAR FOOTING	$1+0.2B/L$	$1+0.2B/L$	$1-0.4B/L$

SQUARE FOOTING	
$S_c =$	1.300
$S_q =$	1.200
$S_\gamma =$	0.800

The Depth Factor

$d_c =$	$1 + 0.2 D_f / B \times \tan (45^\circ + \phi'/2) =$	1.693
$d_q = d_\gamma =$	1 for $\phi' < 10^\circ$ =	1.000
$d_q = d_\gamma =$	$1 + 0.1 D_f / B \tan(45^\circ + \phi'/2)$ for $\phi' > 10^\circ =$	1.346

The Inclination Factor

$i_c = i_q =$	$1 - \alpha / 90$	$1 - \alpha / \phi'$
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α = Inclination of the load to the vertical in degree =

0

$$\begin{aligned} \text{Net Ultimate Bearing Capacity, } q_d = & (c \times N_c \times S_c \times d_c \times i_c) + (q \times (N_q - 1) \times S_q \times d_q \times i_q) + \\ & (0.5 \times B \times \gamma \times N_\gamma \times S_\gamma \times d_\gamma \times i_\gamma \times W') + (2/3) (c \times N' \times c \times S_c \times d_c \times i_c) + (q \times (N' \times q - 1) \times S_q \times d_q \times i_q) + (0.5 \times B \times \gamma \times N' \times \gamma \times S_\gamma \times d_\gamma \times i_\gamma \times W')) / \gamma \\ = & 54.35 \quad \text{T/sq.m} \end{aligned}$$

SAFE BEARING CAPACITY :

$$\text{SBC} = q_d / F.s = \quad \quad \quad \mathbf{21.74 \text{ T/sq.m}} \quad \quad \text{or} \quad \quad \mathbf{213.29 \text{ kN/m}^2}$$

SETTLEMENT CALCULATIONS AS PER IS-8009-(part-1) 1998

Q_s = Pressure, S_i = Immediate settlement I = Influence factor

B = width of foundation μ = Poisson's ratio E_s = Elastic Modulus

For,

Medium Consolidated Sand

$$E = 1200(N+6)$$

$$E_s = 24000 \text{ kN/m}^2$$

$$(\text{or}) E_s = 2400.00 \text{ t/m}^2$$

$$S_i = 0.0097 \text{ m}$$

$$0.0097 \times 1000$$

$$\text{Settlement} = \quad \quad \quad \mathbf{10 \text{ mm}} < \mathbf{50 \text{ mm}} \quad \quad \mathbf{\text{Hence SAFE}}$$

The Max Allowable Differential Settlement for **Sand & Gravel** is **50mm** and for **Silt & Clay** is **75mm**.

**GEOMATRIX CONSULTANCY**

Geo-Tech. Consultants & Engineers

Name of Project : **Sub Soil Investigation for the Construction of SOLAR POWER PLANT at V.O.Chidambaranar Port Trust, Tuticorin.**

REPORT NO : 131A/ GMC 17-18

BH No : 3

CALCULATION - 8

SAFE BEARING CAPACITY CALCULATIONS on SHALLOW FOUNDATIONS**TYPE OF FOOTING : SQUARE FOOTING**

Breadth of footing	(Assumed value)	B =	1.50 m
Foundation depth		D _f =	3.00 m
Correction Factor for Water Table		W' =	0.50
Unit weight of soil		γ _{soil} =	1.760 T/m³
Cohension		"C" =	0.00 T/m²
Angle of shearing resistance(general shear)	φ =		30.00°
Angle of shearing resistance(Local shear)	φ' =		21.02° (Tan⁻¹ (2/3 * tanφ)
Safety factor		F =	2.50
Effective Surcharge of Soil above Footing Base		q =	2.28 T/m²
Type of soil			= Medium Consolidated Sand
Mode of failure			= Combined (GSF & LSF) Shear Failure
Ground Water Table level (Assumed for worst Case - at the Ground level) =			0 m From NGL

The Bearing Capacity Factors are Given by the following equations

For GENERAL SHEAR FAILURE

$$N_q = \tan^2 (45^\circ + \phi') (e^{\pi \tan \phi'}) = 18.401$$

$$N_c = (N_q - 1) \cot \phi' = 30.139$$

$$N_\gamma = 2 (N_q + 1) \tan \phi' = 22.402$$

For LOCAL SHEAR FAILURE

$$N'_q = \tan^2 (45^\circ + \phi') (e^{\pi \tan \phi'}) = 7.085$$

$$N'_c = (N_q - 1) \cot \phi' = 15.835$$

$$N'_\gamma = 2 (N_q + 1) \tan \phi' = 6.214$$

The Shape Factors

Shape of Footing	S_c	S_q	S_γ
CONTINUOUS STRIP FOOTING	1.0	1.0	1.0
SQUARE FOOTING	1.3	1.2	0.8
RECTANGULAR FOOTING	$1+0.2B/L$	$1+0.2B/L$	$1-0.4B/L$

SQUARE FOOTING	
$S_c =$	1.300
$S_q =$	1.200
$S_\gamma =$	0.800

The Depth Factor

$d_c =$	$1 + 0.2 D_f / B \times \tan (45^\circ + \phi'/2) =$	1.693
$d_q = d_\gamma =$	1 for $\phi' < 10^\circ$ =	1.000
$d_q = d_\gamma =$	$1 + 0.1 D_f / B \tan(45^\circ + \phi'/2)$ for $\phi' > 10^\circ =$	1.346

The Inclination Factor

$i_c = i_q =$	$1 - \alpha / 90$	$1 - \alpha / \phi'$
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α = Inclination of the load to the vertical in degrees =

0

$$\begin{aligned} \text{Net Ultimate Bearing Capacity, } q_d = & (c N_c S_c d_c i_c) + (q (N_q - 1) S_q d_q i_q) + \\ & (0.5 B \gamma N_\gamma S_\gamma d_\gamma i_\gamma W') + (2/3) (c N' c S_c d_c i_c) + (q (N' q - 1) S_q d_q i_q) + (0.5 B \gamma N' \gamma S_\gamma d_\gamma i_\gamma W') / W'^2 \\ = & 53.41 \quad \text{T/sq.m} \end{aligned}$$

SAFE BEARING CAPACITY :

$$SBC = q_d / F.s = \quad \mathbf{21.37 \text{ T/sq.m}} \quad \text{or} \quad \mathbf{209.60 \text{ kN/m}^2}$$

SETTLEMENT CALCULATIONS AS PER IS-8009-(part-1) 1998

Q_s = Pressure, S_i = Immediate settlement I = Influence factor

B = width of foundation μ = Poisson's ratio E_s = Elastic Modulus

For,

Medium Consolidated Sand

$$E = 1200(N+6)$$

$$E_s = 20400 \text{ kN/m}^2$$

$$(or) E_s = 2040.00 \text{ t/m}^2$$

$$S_i = 0.0112 \text{ m}$$

$$0.0112 \times 1000$$

$$\text{Settlement} = \quad \mathbf{11 \text{ mm}} \quad < \quad \mathbf{50 \text{ mm}} \quad \mathbf{Hence SAFE}$$

The Max Allowable Differential Settlement for **Sand & Gravel is 50mm** and for **Silt & Clay is 75mm.**



SECTION - VIII

SCHEDULE OF RATES (SOR)

5 MW (AC) SPV Project

Tender No
SECI/C&P/PMC/11/0001/2021-22

SOR
Page 1 of 3

Signature
of Bidder

1. **Bidders are required to quote for the Total Contract Price on Lumpsum basis in cognizance with the Tender Terms & Conditions.**
2. Bidder's quoted prices shall be strictly as per various Formats included under this Section [i.e. Section-VIII, Schedule of Rates (SOR)]. Bidder shall quote Lumpsum (LS) Price for the entire scope of work including Design, Engineering, Manufacture, Supply, Storage, Civil Work, Erection, Testing & Commissioning as per the Technical Specifications (TS) as defined under Section-VII.
3. All the Columns of quoted items in the Schedule of Rates including currency must be filled with required information, as applicable.
4. Bidder must quote the price in enclosed SOR formats only. The formats shall not be changed and/ or retyped.
5. Bidder to note that breakup of Lumpsum price is to be provided for assessment of Evaluated Bid Value (EBV), however total price payable under the Contract shall be restricted to the Lumpsum Price/ Contract Price only.
6. The Lumpsum Price shall be considered as Total Contract Price Which Owner agrees to pay and the Contractor agrees to accept as full compensation for the Contractor's full performance of the Work in accordance with the provisions of the Contract Documents. Contract Price shall not be subjected to any adjustment except in case of Change Order or Statutory Variations in accordance with the provisions of the Contract.
7. The price quoted shall be Lumpsum price on Turnkey basis. Unless the basic parameter changes or additional/ extra requirements are made, total payments to be made to the contractor shall be limited to Lumpsum price indicated, irrespective of the progressive payments made during execution based on the split up of price.
8. Obligation of the Contractor is not limited to the quantities that the Contractor may either indicate in the Schedule of Breakup of Lumpsum Prices along with his bid or in further detailed break of Lumpsum prices furnished along with the bid or after award of work. Contractor shall carry entire scope of work/ supplies as detailed in various sections/ volumes of the Tender Document within the quoted Lumpsum Price (Contract Price).
9. Lumpsum Prices quoted by the Bidder shall include cost of any other supplies/ work(s) not specifically mentioned in the Bidding Document but necessary for the efficient, trouble free commissioning & operation of the Plant and to make this package job complete. Quoted price is FIRM and fixed till complete execution of the entire order. Also, variation on account of Foreign Exchange rate is not to be payable extra.
10. Spares for start-up/ commissioning and mandatory spares required are in Contractor's Scope and deemed included in the quoted Lumpsum Prices.
11. Bidder shall furnish following Forms of Schedule of Rates: -
 - a) SOR -1 is the Schedule and Breakup of Lump sum Price (Supply, Service and NPV of O&M) of the Tender. SOR -2 comprises of the yearly Breakup of the NPV of O&M price for 10 years period.

5 MW (AC) SPV Project	Tender No <u>SEC/C&P/PMC/11/0001/2021-22</u>	SOR <u>Page 2 of 3</u>	Signature <u>of Bidder</u>
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b) Details of Goods & Service Tax (GST) as included in SOR-1

c) Prices shall be considered for evaluation on NPV basis as per Evaluation Methodology Specified in Section III ITB of the Tender Document.

12. IINR = Indian Rupees

13. Bidder confirms that he has noted the contents of the Preamble to the Schedule of Rates, Schedule of Rate, Bid Document and quoted his Prices accordingly without any deviation.

14. O & M Charges on YoY basis must be equal or in ascending order only.