SECTION - I

INVITATION FOR BIDS (IFB)

INVITATION FOR BIDS (IFB)

FOR

Tender for Design, Engineering, Supply, Construction, Erection, Testing, Commissioning including 5 Years Plant O&M of 2 MW (AC) Solar PV Power Plant with 01 MW BESS at KAZA, Himachal Pradesh

(SINGLE STAGE TWO ENVELOPE BIDDING)
Under e-Tendering

1.0 Himachal Renewables Limited is a Public incorporated on 14 September 2016. Himachal renewable limited is a JV of Solar Energy Corporation of Limited and Himachal Pradesh state Electricity Board. It is classified as Non-govt Company and is registered at Registrar of Companies, Himachal Pradesh. Its authorized share capital is Rs. 10,000,000 and its paid up capital is Rs. 5,000,000.It is involved in Production , collection and distribution of electricity

2.0 The Himachal Pradesh State Electricity Board was constituted on 1st September, 1971 in accordance with the provisions of Electricity Supply Act (1948) and has been reorganized as Himachal Pradesh State Electricity Board Ltd. w.e.f. 14.06.2010 under company act 1956. Himachal Pradesh State Electricity Board Limited (HPSEBL), having its registered office at Vidyut Bhawan, Shimla- 171004, Himachal Pradesh is responsible for supply of Uninterrupted & Quality power to all categories of consumers in Himachal Pradesh at the most economical rates. This power is being supplied through a network of Transmission, Sub- Transmission & Distribution lines laid along the length and breadth of the Pradesh.

3.0 The EPC/ Tender activities in respect of the aforesaid Project 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 D - 3, 1st Floor, Wing - A, Prius Platinum Building, District Centre, Saket, New Delhi - 110 017 (hereinafter referred to as 'SECI'/ Executing Agency). For the purpose of all procurement activities related to the said works, SECI shall be referred to as 'Executing Agency'.

4.0 Executing Agency (SECI), therefore on behalf of the "Owner/Client" Himachal Renewable Limited (JV of HPSEB and SECI) invites bids from eligible bidders to participate in the Tender for Design, Engineering, Supply, Construction, Erection, Testing, Commissioning including 5 Years Plant O&M of 2 MW (AC) Solar PV Power Plant with 01 MW BESS at KAZA, Himachal pradesh.

5.0 **VOID**

6.0 The complete Bidding Documents are available at TCIL portal ***https://www.tcil-india-electronictender.com*** as well as on SECI's website ***http://www.seci.co.in***. Interested bidders shall download the Bidding Documents from the portal ***https://www.tcil-india-electronictender.com*** as per the provisions available therein.

7.0 Interested bidders have to necessarily register themselves on the portal ***https://www.tcil-india-electronictender.com*** through M/s Telecommunications Consultants India Limited (TCIL), New Delhi to participate in the bidding under this invitation for bids. It shall be the sole responsibility of the interested bidders to get themselves registered at the aforesaid portal for which they are required to contact M/s TCIL, New Delhi to complete the registration formalities. The address of M/s TCIL is mentioned on the Bid Information Sheet. All required documents and formalities for registering on TCIL 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.

For proper uploading of the bids on the portal namely ***https://www.tcil-india-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 Telecommunications Consultants India Limited, New Delhi directly, as and when required, for which contact details are also mentioned on the Bid Information Sheet. The Executing agency 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 Executing agency 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 of not opening of the bid with the pass-phrase provided by the bidder, Executing agency 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, Executing agency shall not be responsible if bid could not be opened within reasonable time for what so ever 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 will be adopted and will proceed 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 Executing agency and the Bidder/ Contractor shall be governed by the Bidding Documents/ Contract signed between the Executing agency 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 TCIL (***https://www.tcil-india-electronictender.com***), SECI website ***http://www.seci.co.in*** 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) 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) will be rejected. **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 TCIL (***https://www.tcil-india-electronictender.com***) or from SECI website (***http://www.seci.co.in***). **It is mandatory to download official copy of Tender Document from Electronic Tender System (ETS) Portal of TCIL to participate in the Tender**. Any amendment(s)/ corrigendum(s)/ clarification(s) with respect to this Tender shall be uploaded on TCIL website. The Bidder should regularly check for any Amendment(s)/ Corrigendum(s)/ Clarification(s) on the above mentioned TCIL website. 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 TCIL website shall prevail**.

13.0 The detailed scope of work includes :

13.1 Design, Engineering, Supply, Construction, Erection, Testing, Commissioning of 2 MW (AC) Solar PV Power Plant with 01 MW BESS at KAZA, Himachal Pradesh.

13.2 Comprehensive operation & maintenance of the Solar PV Power Plant for 5 (Five) 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 In case a Tender provides provision for multiple bids by a common bidder, then separate EMD(s) and Tender Processing Fees shall be furnished for all the bids as listed out in the Tender along with the response to Tender. Kindly refer the Clause of Bid Information Sheet for details. EMD shall be enclosed in a sealed envelope and shall be submitted in the office of Executing agency (offline) whose mailing address is mentioned in the Bid Information Sheet.

15.0 For multiple packages, separate Performance Securities shall be furnished against each package being executed under this Tender (*indicating the list of Packages as per Tender where project(s) are to be executed)* by the successful bidder after issuance of Notification of Award (NOA)/ Letter of Intent (LOI)/ Letter of Allocation (LOA) by Owner.

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

17.0 The Executing agency shall conduct e-Reverse Auction (e-RA), if required or as per provisions of **Special Conditions of Contract (SCC) /Instructions to Bidders (ITB)** of Tender documents.

18.0 ***Executing agency/ 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 differentiation 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**	Design & engineering, procurement & supply of equipment and materials, testing at manufacturers works, multi – level inspections, packing and forwarding, receipt, unloading and storage at site, associated civil works, services, permits, licences, installation and incidentals, insurance at all stages, erection, testing and commissioning of 2 MW (AC) Grid Interactive Solar PV Power Plant with 01 MW BESS and performance demonstration with associated equipment and materials on turnkey basis at KAZA, Himachal Pradesh along with 5 (five) years comprehensive operation and maintenance from the date of Operational Acceptance. 1. Design, Procurement & Supply and erection of the following, in all respect: 1.1 Adequate capacity of solar PV modules of suitable rating panels including module mounting structures and fasteners, MMS foundation and module interconnection 1.2 Power Conditioning Units (PCU) with SCADA compatibility, common AC power evacuation panel with bus bars and circuit breakers LT & HT Power Interfacing Panels, Plant Monitoring Desk, AC & DC Distribution boards. 1.3. Array Junction boxes, distribution boxes and Fuse boxes: MCBs/ isolators, Surge Arrestors with string monitoring

		capabilities and with proper lugs, glands, ferrules, terminations and mounting structures. 1.4. Containerized BESS comprising of unit batteries, battery management system (BMS), auxiliaries, such as HVAC and fire suppression systems, step-up transformers to match utility grid, ac switchgear, Control Systems etc. with Power and Energy ratings as specified. 1.5. Step – up transformers in relevance with state grid code and inverter manufacturer requirements. Auxiliary transformer (s) for internal consumption. 1.6. Metering and protection system along with its battery system. 1.7. Indoor switchgear and panels having incoming and outgoing feeders with VCBs, CTs, PTs, Bus bars, cables terminals kits and bus section panel. The control and relay panel should form integral part of the switchgear (i.e., should be physically integrated into one unit). The switchgear will be installed in a separate switchgear room. 1.8. ABT meters (Main and Check) with all necessary metering rated CT's and PT's at the plant take off point as well as at the substation as per CEA Metering Regulation 2006 as amended time to time and state metering code. 1.9. Data acquisition system with remote monitoring facilities. Provision for specific data transfer to the State Load Dispatch Centre (SLDC) shall also be provided. 1.10 Design of associated civil, structural, electrical & mechanical auxiliary and plumbing systems include preparation of single line diagrams and installation drawings, manuals, electrical layouts, erection key diagrams, electrical and physical clearance diagrams, design calculations for civil, structural, RCC and plumbing works, roads and drainage etc. including analysis & design input file, Earth- mat, Bus Bar & Spacers, Indoor and outdoor lighting/ illumination etc., GTP and GA drawings for the major equipment including transmission line etc 1.11 Spares & consumables, as required or recommended, for the complete O&M period. 1.12 Testing instruments for maintenance and monitoring of equipment 1.13 The detailed scope of work is given in Section VII: Scope of Work, specifications and Drawings of this bidding documents.
(B)	**TENDER NO. & DATE**	SECI/C&P/KAZA/072018 dated 27/07/2018

(C)	**MULTIPLE BIDDING SYSTEM**	ALLOWED: ☐ NOT ALLOWED: Yes
(D)	**TYPE OF TENDER**	E-TENDER: Yes MANUAL: ☐
(E)	**COMPLETION/ CONTRACT PERIOD**	As mentioned in Special Conditions of Contract (SCC).
(F)	**TENDER PROCESSING FEE**	APPLICABLE: Yes NOT APPLICABLE: ☐ **Amount: INR 1,06,200/- (Indian Rupees One Lacs & Six thousand Two Hundred only) inclusive of GST @ 18%**
(G)	**EARNEST MONEY DEPOSIT (EMD)**	APPLICABLE: Yes NOT APPLICABLE: ☐ **Amount: INR 36, 00,000/- (Indian Rupees Thirty Six lacs only).**
(H)	**CONTRACT PERFORMANCE SECURITY**	APPLICABLE: Yes NOT APPLICABLE: ☐
(I)	**DATE, TIME & VENUE OF PRE-BID MEETING**	1100 HRS (IST) on 09/08/2018 at SECO Office, New Delhi Kind Attn.: Shri Sanjay Sharma (GM)

		Telephone Nos.: - +91 1171989256 E mail: contracts@seci.co.in
(J)	**OFFLINE & ONLINE BID-SUBMISSION DEADLINE**	27/08/2018 up to 1400 HRS
(K)	**OFFLINE & ONLINE BID OPENING**	27/08/2018, 1600 HRS onwards
(L)	**FINANCIAL BID OPENING**	To be intimated subsequent to the shortlisting of Techno Commercial Bids
(M)	**TECHNICAL QUERIES CONTACT DETAILS**	**Dr YBK Reddy** Deputy General Manager (Solar) OR **Mr. Prashant Kumar Upadhyay** Deputy Manager (Solar) Solar Energy Corporation of India Limited (A Government of India Enterprise) D - 3, 1st Floor, Wing - A, Prius Platinum Building, District Centre, Saket, New Delhi - 110 017 Phone: 011-71989200/ 71989239/ 71989230
(N)	**CONTACT DETAILS OF TCIL**	M/s Telecommunications Consultants India Limited 6th Floor, TCIL Bhawan, Greater Kailash - 1 New Delhi - 110 048 Contact Person : ETS Support Team Contact No. : 011 26202699 (Multiline) / 26241790 / 26202661 Email : ***ets_support@tcil-india.com***

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 quote 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 TCIL **(*https://www.tcil-india-electronictender.com*)** and/ or SECI website **(*www.seci.co.in*)** and submit their Bid complete in all respect as per terms & conditions of Tender Document on or before the due date of bid submission.

4.0 Clarification(s)/ Corrigendum(s) if any shall also be available on above referred websites.

5.0 NOA/ LOI/ LOA for LSTK (Lump Sum Turn Key)/ EPC (Engineering, Procurement & Commissioning) job shall be issued to successful bidder(s). The NOA/ LOI/ LOA for LSTK/ EPC job shall be awarded in following respective parts as mentioned briefly below: -

(i) **First Contract (Supply and Services):** FOR destination basis Supply including Transportation for delivery at site and Insurance of all Equipment and materials including mandatory spares and any other supplies specified in the Contract Documents & providing all services i.e., including Unloading, Storage, Handling at Site, Civil Works, Erection, Installation, Testing and Commissioning including Performance Testing in respect of all the Equipment supplied under the scope of Supply and any other services specified in the Contract Documents..

(ii) **Second Contract (O&M)**: For providing Comprehensive operation & maintenance of the Solar PV plant for 5 (Five) years 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.

Both contracts will contain a cross fall breach clause specifying that breach of one will constitute breach of the other

6.0 However, the above-mentioned contract award methodology may be modified/ changed based on specific project requirements and upon sole discretion of Executing Agency/ Owner.

SECTION - II

INSTRUCTION TO BIDDERS (ITB)

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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 Executing Agency/ Owner. It also provides information on bid submission and uploading the bid on portal ***https://www.tcil-india-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. If there is a conflict between the provisions of Section – II, Section – III and Section - V, the provisions of Section - V shall prevail.

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 Executing Agency/ Owner and Bidders/ Contractors shall be governed by the Tender Documents/ Contracts signed between the Executing Agency/ Owner and the Contractor for the respective package(s). 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 Section - II, Section - III and the Section - V of the Tender Documents, the laws of the Union of India shall be the governing laws and courts of New Delhi shall have exclusive jurisdiction.

[A] - GENERAL

1 SCOPE OF BID

1.1 The Executing agency/ Owner, wishes to receive Bids as described in the Bidding documents/ Tender documents issued by Executing agency/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 Throughout the Tender Documents, the terms 'Bid', 'Tender' & 'Offer' and their derivatives [Bidder/ Tenderer, Bidding Documents/ Tender Documents, Bid/ Tender/ Offer etc.] are synonymous. Further, '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 Executing Agency 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 shall not be debarred by Executing Agency/ Owner/ Ministry of New & Renewable Energy (MNRE) for future bidding due to "poor performance" or "corrupt and fraudulent practices" or any other reason in the past. Further, neither bidder nor their allied agency(ies) (as defined in the Procedure for Action in case of Corrupt/ Fraudulent/ Collusive/ Coercive Practices) should be on the banning list of Executing Agency/ Owner or the Ministry of New & Renewable Energy (MNRE).

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

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

It shall be the sole responsibility of the bidder to inform Executing Agency/ Owner/ MNRE in case the bidder is debarred from bidding by Executing Agency/ Owner/ MNRE 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 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 Executing Agency/ Owner by the bidder.

It shall be the sole responsibility of the bidder to inform Executing Agency/ 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 Executing Agency/ 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 Executing Agency/ Owner as an Engineer/ Consultant for the contract.

2.5 Neither the entity [appointed as the Project Management Consultant (PMC) 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 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 - A to BDS) shall be complied upon.

4 NUMBER OF BIDS PER BIDDER

4.1 Unless specified otherwise, 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.

However multiple bids from a single bidder can be considered depending upon project specific requirement as mentioned in BDS.

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, Executing Agency/ 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 'crossed payee accounts only' 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 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 Executing Agency and shall not be returned under any circumstances. No plea in this regard shall be entertained by the Executing Agency/ Owner.

5.5 In the event of a particular tender being cancelled, 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 Executing Agency/ Owner.

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 Executing Agency/ Owner to enter upon its premises and land for the purpose of such visits, but only upon the express conditions that the Bidder, its personnel and agents will release and indemnify the Executing Agency/ 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 Executing Agency/ Owner for non-compliance due to lack of any kind of pre-requisite information as it is the sole responsibility of the Bidderto 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

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, Executing Agency/ 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 Executing Agency in writing by E-mail or at Executing Agency'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). Executing Agency reserves the right to ignore the bidders request for clarification if received beyond the aforesaid period. Executing Agency may respond in writing to the request for clarification. Executing Agency's response including an explanation of the query, but without identifying the source of the query will be uploaded on ETS Portal of TCIL ***https://www.tcil-india-electronictender.com*** and/ or Executing Agency's website ***www.seci.co.in***.

8.2 Any clarification or information required by the Bidder but same not received by the Executing Agency at clause 8.1 above is liable to be considered as "no clarification/ information required".

9 AMENDMENT OF TENDER DOCUMENTS

9.1 At any time prior to the 'Bid Due Date', Executing Agency/ 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 TCIL ***https://www.tcil-india-electronictender.com*** and/ or Executing Agency's website ***www.seci.co.in***. Bidders have to take into account all such addendum/ corrigendum before submitting their bid.

9.3 The Executing Agency, 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 Executing Agency/ 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. Hard Copy

Hard copy 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)}**.

Contact Person Name: Shri Kartik Ganesan

(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-4' or as prescribed.
(e) In case of Bid from Joint Venture, the Joint Venture Agreement (as per 'Form F-17') and Power of Attorney for Joint Venture Agreement (as per 'Form F-17A') (both in Original)
(f) In case of Bid from Consortium, the Consortium Agreement (as per 'Form F-18') and Power of Attorney for Consortium Agreement (as per 'Form F-18A') (both in Original)
(g) Power of Attorney for authorized signatory in non-judicial stamp paper (as per 'Form F-24')
(h) Copy of Board Resolution on organization letter head
(i) 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 as Programmed File Attachments during online Bid Submission as a part of First envelope.

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

II. **Soft Copy**

Soft copy of the bid shall comprise of following documents to be uploaded on the TCIL portal ***https://www.tcil-india-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 TCIL portal, shall be duly filled.

II. Programmed file - Attachments (as detailed against clause no. 11.I) and Bid Form for first envelope.

III. Certificate of Incorporation

IV. Copy of MoA And AoA

V. 'Bidder's General Information', as per 'Form F-1'.

VI. Shareholding Certificate (as per 'Form F-23')

VII. 'No Deviation Confirmation', as per 'Form F-6'

VIII. 'Bidder's Declaration regarding Banning, Liquidation etc.', as per 'Form F-7'

IX. 'Bidders Experience as per 'Form F-13'

X. E-Banking Format (as per 'Form F-19')

XI. Documents in accordance with the "Qualifying Requirements (QR)" establishing the qualification

XII. 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

XIII. Tender Document. (Only First and Last Pages of Original Tender Document duly sealed and signed/ digitally signed and all pages of amendments and clarifications to Tender Documents duly sealed and signed/ digitally signed by the Authorized Signatory).

(b) As part of Second Envelope

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

II. 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 5 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 Executing Agency/ 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 and any variation in item description, unit or quantity is noticed, 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.

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 opening 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, SECI shall ensure that the Contractor has complied with all the required statutory requirements under GST. SECI 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 CENVAT benefit of the taxes due to 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, Executing Agency/ Owner may seek copies of challan and

certificate from Chartered Accountant for deposit of GST collected from Executing Agency/ Owner.

13.3 In case CBEC (Central Board of Excise and Customs) brings to the notice of Executing Agency/ Owner that the contractor has not remitted the amount towards GST collected from Executing Agency/ Owner to the government exchequer, then, that contractor may be debarred from bidding in future tenders of Executing Agency/ Owner for given period as per the sole discretion of Executing Agency/ 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-cenvatable GST beyond the contractual completion period shall be to contractor's account whereas any decrease in the rate shall be passed on to the Executing Agency/ Owner.

b) The base date for the purpose of applying statutory variation shall be the date of techno-commercial bid opening.

13.5 **Void**

13.6 Where the Executing Agency/ Owner is entitled to avail/ take the CENVAT credit of GST:

13.6.1 Owner/ Executing Agency will reimburse the GST to the Contractor at actuals against submission of cenvatable invoices issued in accordance with GST rules to enable Owner/ Executing Agency to claim cenvat credit of GST paid. In case of any variation in the executed quantities, the amount on which the GST is applicable shall be modified in same proportion.

13.6.2 **Void**

13.7 Where the Executing Agency/ Owner is not entitled to avail/ take the CENVAT credit of GST:

13.7.1 Owner/ Executing Agency 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.

13.8 **Void**

13.9 Contractor shall ensure timely submission of correct invoice(s) with all required supporting document(s) within a period specified in NOA/ LOI/ LOA/ CA to enable Executing Agency/ Owner to avail CENVAT credit, If applicable.

If CENVAT credit with respect to GST tax is not available to Executing Agency/ Owner for any reason which is not attributable to Contractor, then Executing Agency/ Owner shall not be

obligated or liable to pay or reimburse GST charged in the invoice(s) or shall be entitled to deduct/ setoff/ recover such GST together with all penalties and interest if any, against any amounts paid or payable by Executing Agency/ Owner to Contractor.

14 BID CURRENCIES:

Bidders must submit bid in Indian Rupees (INR) only.

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 Executing Agency as 'non-responsive'.

15.2 In exceptional circumstances, prior to expiry of the original 'Bid Validity Period', the Executing Agency 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'. 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' 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 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.

16.2 The **'EMD'** is required to protect Executing Agency/ Owner against the risk of Bidder's conduct, which would warrant the EMD's forfeiture, pursuant to "ITB: Clause-16.7".

16.3 Executing Agency/ 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).

16.4 Bid not accompanied with required amount of EMD or required validity or not in requisite format shall be liable for rejection.

16.5.1 'Earnest Money Deposit' of unsuccessful Bidders disqualified at the stage of Techno-Commercial evaluation will be discharged/ returned as promptly as possible, but not later than '30 [thirty] days' after intimation of their disqualification.

16.5.2 'Earnest Money Deposit' of unsuccessful Bidders excluding L-2 bidder will be discharged/ returned as promptly as possible, but not later than '30 [thirty] days' after issuance of NOA/ LOI/ LOA to successful bidder.

16.5.3 'Earnest Money Deposit' of L-2 bidder will be discharged against the acceptance and signing of Contract Agreement with successful bidder. This process shall be completed not later than '30 [thirty] days' after issuance of NOA/ LOI/ LOA to successful bidder.

16.6 The successful bidder's 'Earnest Money Deposit' will be discharged upon the Bidder's acknowledging the 'Award' and signing the 'Agreement' and furnishing the 'Performance Security' pursuant to clause nos. 37 & 38 of ITB.

16.7 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) If the Bidder modifies bids during the period of bid validity (after last date of submission).
(d) Violates any other condition, mentioned elsewhere in the tender document, which may lead to forfeiture of EMD.
(e) In the case of a successful Bidder, if the Bidder fails to:
    (i) Acknowledge receipt the NOA/ LOI/ LOA within 15 (Fifteen) days from issuance of same.
    (ii) to furnish "Performance Security in accordance with "ITB : Clause-38"
    (iii) to accept 'arithmetical corrections' as per provision of the clause 30 of ITB.

16.8 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-4'.

16.9 **MSMEs (Micro, Small and Medium Enterprises) registered under NSIC/ Udyog Aadhar/DIC Only are exempted from submission of EMD. In order to avail the exemption in EMD in case of Consortium/ JV, all the members of the Consortium/ JV should be registered as MSME Vendors under NSIC/ Udyog Aadhaar Category/DIC.**

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 TCIL 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 Executing Agency/ 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 FORMAT AND SIGNING OF BID

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 on TCIL 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. Executing Agency/ Owner will accept bids based on terms & conditions of Tender Documents only. Bidder may note Executing Agency/ 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. Executing Agency's/ Owner's determination of a bid's responsiveness is based on the content of the bid itself without recourse to extrinsic evidence. Executing Agency/ 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

Executing Agency/ 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 Hard Copies (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 including 5 Years Plant O&M of 2 MW (AC) Solar PV Power Plant with 01 MW BESS at KAZA, Himachal Pradesh"	
Tender Document No.	**SECI/C&P/KAZA/072018**
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)** **D - 3, 1st Floor, Wing - A, Prius Platinum Building** **District Center, Saket** **New Delhi - 110 017**

21.3 All the bids shall be addressed to the Executing Agency 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 hard copies 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).

22.3 Executing Agency/ 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 Executing Agency/ 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 TCIL ***https://www.tcil-india-electronictender.com*** and/ or Executing Agency'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.

24.2 The modification shall also the prepared, sealed, marked and dispatched in accordance with the provision of the clause 22 of ITB, with the after 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 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, Executing Agency shall forfeit EMD 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 Executing Agency/ Owner after following the due procedure.

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

Executing Agency/ 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 Executing Agency's/ Owner's action. However, Bidder if so desire may seek the reason (in writing) for rejection of their Bid to which Executing Agency/ Owner shall respond quickly.

[E] - BID OPENING AND EVALUATION

26 BID OPENING

26.1 ***Unpriced Bid Opening:***

As the case may be, Executing Agency 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 Executing Agency/ Owner.

26.2 ***Priced Bid Opening***:

26.2.1 Executing Agency 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.

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 Executing Agency'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 EXECUTING AGENCY/ OWNER

28.1 From the time of Bid opening to the time of award of Contract, if any Bidder wishes to contact the Executing Agency/ 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 Executing Agency/ Owner in the Executing Agency's 'Bid Evaluation', 'Bid Comparison', or 'Contract Award' decisions may result in the rejection of the Bidder's 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 Executing Agency will determine whether each Bid: -

(a) Meets the "Bid Evaluation Criteria" of the Bidding Documents;
(b) Has been properly signed;
(c) Is accompanied by the required 'Earnest Money Deposit' and 'Tender Processing Fees', if applicable
(d) Is substantially responsive to the requirements of the Tender Documents; and
(e) Provides any clarification and/ or substantiation that the Executing Agency/ 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 Executing Agency 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 Executing Agency's rights or the tenderer'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 Executing Agency 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 Executing Agency and may not subsequently be made responsive by correction or withdrawal of the 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 Executing Agency, 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 Executing Agency shall be entitled to consider the highest price 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 Executing Agency 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 cost including GST. The Executing Agency 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 Executing Agency 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 Executing Agency 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 and Drawings to 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 Executing Agency/ 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 Executing Agency

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. A negative determination of the bids pursuant to ITB Clause 32.1 the Second Envelope submitted by such bidders shall be sent to archive unopened and the EMD 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.

Bids not opened and read out at bid opening shall not be considered for evaluation, irrespective of the circumstances except bids received by Executing Agency within due date and time of bid submission deadline.

32.3 Evaluation of Financial Part (Second Envelope)

32.3.1 The Executing Agency will examine the Price Parts (Second Envelopes) to determine whether they are complete, whether any computational errors have been made, whether the documents have been properly 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 Bidding Documents.

32.3.6 The Executing Agency'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 FOR destination basis Supply including Transportation for delivery at site and Insurance of all Equipments and materials including mandatory spares and any other supplies specified in the Contract Documents, providing all services i.e. 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 Contract 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 Section - VIII, Schedule of Rates (SOR) of 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 5 years period.

Bidder to mention the NPV of O&M amount for total 5 years in CELL NO I 22 OF SOR-1 which should match with the NPV of O&M amount for total 5 years in CELL NO J 18 of 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 9.08%

32.4 Evaluation of Price Bid

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

a) 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).

b) The mentioned Total Evaluated Bid Value will be considered up to 2 decimal places only.

c) Bidder with 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)

d) The Total Evaluated Bid Value shall be inclusive of Goods & Service Tax (GST) as quoted by the bidder. However, the award shall be placed including of GST. However, the taxation bifurcation shall be submitted by the successful bidder in the SOR format.

e) 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 5 years period.

f) Bidder to mention the NPV of O&M amount for total 5 years in CELL NO I 22 of SOR-1 which should match with the NPV of O&M amount for total 5 years in CELL NO J 23 of SOR 2.

g) In case of any variation of the total NPV of O&M price, the NPV of O&M amount for total 5 years mentioned at CELL NO J 23 of SOR 2 will be considered for evaluation purpose.

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

1. The e-auctioning shall be conducted on **www.tcil-india-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. Of this top 50% of the bidders starting from the LI Bid subject to minimum of 3 bids shall only be eligible for 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. The e-RA shall be conducted as follows:

- At least one week prior to e-RA, an advance intimation regarding the date and time of the e-RA will be sent to by email to all bidders whose technical 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 TCIL website of eauctioninging 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 the EPC price quoted by the bidder only. The NPV value of O&M price Bid shall remain fixed.

- The minimum decrement step for e-Auctioning is ***Rs. 50,000/- (INR Fifty Thousand only)*** in EPC Price bid (Firm value of the financial proposal as the sum of individual bid value of supply, erection and civil works including GST), i.e. each decrement shall be in multiples of Rs.

50,000/- (INR Fifty Thousand only). The multiples of bid decrement are 1, 2, 3…10, 15, 20, 25…50,100 (as per TCIL ETS). Further to the above, the prospective bidders may also note that whatever the discount offered by the bidder during the e – RA process on the price quoted by them during financial bid, the same shall be applied proportionately to the prices of items quoted by them initially in the financial bid, for making payments if such bidder is concluded as the successful bidder for the Notification of Award (NOA).

- 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 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 O&M price as their start price initially and thereafter last quoted EPC Price

- The O&M price (mentioned with NPV) shall remain fixed throughout the process.

- The list of last quoted EPC price (i.e. last Bid Value) along with NPV of O&M price (fixed) of all bidders with their Pseudo Identities and their time of quote.

4. Selection of Successful Bidders

The bidders shall be selected in the ascending order with lowest quoted Total Price (EPC + NPV of O&M price) (being L1).

a. The final price arrived by adding the EPC price (as a result of e-auctioning process) and the NPV of O&M price (fixed during e-auctioning).

b. The bidder with lowest sum quoted at the end of E- Reverse Auctioning will be considered L1.

c. In case of tie in Total Price (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 other-wise based on First Round quotation or annulment of tender 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 **www.tcil-india-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.

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', Executing Agency/ 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 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 acknowledgement within 15 (Fifteen) days from the date of its issuance.

36.4 Incase 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 Executing Agency/ Owner may take suitable action to get the project successfully executed

36.5 In case of Non-response/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 by annulling the entire Tendering process.

37 SIGNING OF CONTRACT AGREEMENT

37.1 The successful Bidder/ Contractor shall be required to execute the 'Contract Agreement' with Owner (r&d) 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) only, within '30 [Thirty] days' of issuance of the "Notification of Award [NOA]"/ “Letter of Intent [LOI]/ “Letter of Allocation [LOA]”.

37.2 Incase 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 Executing Agency/ Owner may take suitable action to get the project successfully executed. Same may constitute sufficient grounds for the forfeiture of EMD.

37.3 In case of Non-response/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 by annulling the entire Tendering process.

CONTRACT PERFORMANCE SECURITY

38.1 Against EPC/ LSTK Contract & Comprehensive Annual maintenance contract (CAMC) of the project, within 30 (Thirty) days from the issuance of the Notification of Award/ Letter of Intent/ Letter of Allocation from Executing Agency/ 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 or Bank Guarantee and shall be in the currency of the Contract and will be issued in the name of the owner as **"Himachal renewable limited, Vidyut Bhawan Shimla".** 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).

38.2 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 favour of **Himachal renewable limited, Vidyut Bhawan Shimla.**

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

38.4 ***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.***

38.5 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 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 is likely to burst the ceiling of awarded contract price, the contractor should 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.

38.6 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. Executing Agency/ Owner at its sole discretion may cancel the Contract Agreement/ NOA/ LOI/ LOA & forfeit 100% of EMD, in case Contract Performance Security is not submitted within 40 (Forty) days from issuance of NOA/ LOI/ LOA. However, total project completion period shall remain same. Part Security shall not be accepted.

38.7 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 Executing Agency 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).

38.8 All compensation or other sums of money payable by the Contractor to the Executing Agency/ Owner under terms of this Contract may be deducted from or paid by the encashment or sale 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 Executing Agency/ 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 sale of his Contract Performance Security, or any part thereof. No interest shall be payable by the Executing Agency for sum deposited as Contract Performance Security.

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 Executing Agency'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 Executing Agency/ 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 Executing Agency/ Owner, such decision of Executing Agency/ 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 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), 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 Executing Agency 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 "Appellate Authority" shall mean Committee consisting of Authorized Representatives of Executing Agency/ Owner.

A.7 "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.8 "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.9 "Investigating Agency" shall mean any department or unit of Executing Agency/ Owner investigating into the conduct of Agency/ party and shall include the Vigilance Department of the Executing Agency/ 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) shall be forfeited.

Further, such agency shall be banned for future business with Executing Agency/ 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 Executing Agency/ 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)/ Executing Agency/ Owner whereby the supply/ work/ service and payment etc. will be suspended. The action shall be initiated for putting the agency on banning.

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, the agency shall be banned for future business with Executing Agency/ 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 Executing Agency/ 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 banning order and shall be for a period as may be decided by the Executing Agency/ Owner based on specific case basis. However, minimum banning shall be for 06 (Six) months from the date 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 put on Banning, such agency should 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 should 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 put on the Banning List during tendering and no 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 submitted by the agency shall be returned to the agency.

C.3.3 After opening of price, EMD made by the agency shall be returned; the offer 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 Executing Agency/ 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 submitted by the agency shall be returned to the agency.

D.3.2.3 after opening of price, EMD made by the agency shall be returned; the offer of the agency shall be ignored & will not be further evaluated. If the agency is put on Suspension list for fraud/ mis-appropriation of facts conducted 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.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 Executing Agency/ 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 TCIL **(*https://www.tcil-india-electronictender.com*)** a Government of India Undertaking (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) to access TCIL'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 ***https://www.tcil-india-electronictender.com*** through TCIL, a Government of India Undertaking. 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.

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 Digital Signing Certificate (DSC)-Class II and above.
4.1.2 Register on Electronic Tendering System® (ETS)
4.1.3 Create Marketing Authorities (MAs), Users and assign roles on ETS
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
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 II or above, 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.tcil-india-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 TCIL/ ETS Helpdesk (as given below), to get your registration accepted/ activated.

Important Note:

1. Interested bidders have to download official copy of the RfS/ Tender & other documents after login into the ETS Portal of TCIL (***https://www.tcil-india-electronictender.com***). If the official copy of the documents is not downloaded from ETS Portal of TCIL within the specified period of downloading of RfS/ Tender and other documents, bidder will not be able to participate in the tender.
2. 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.

TCIL/ ETS Helpdesk	
Telephone/ Mobile	**Customer Support: +91-11- 26202699 (Multiple Telephone lines) / 26241790 (Monday to Friday from 10 AM to 6 PM except Government Holidays) Emergency Mobile Numbers: +91-9868393792, 9868393775, 9868393717**
Email-ID	***ets_support@tcil-india.com***

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 Hard Copy (Offline and Online Both)

Hard copy 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)}**.

Contact Persons Name: Shri Kartik Ganesan

(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-4' or as prescribed.
(e) In case of Bid from Joint Venture, the Joint Venture Agreement (as per 'Form F-17') and Power of Attorney for Joint Venture Agreement (as per 'Form F-17A') (both in Original)
(f) In case of Bid from Consortium, the Consortium Agreement (as per 'Form F-18') and Power of Attorney for Consortium Agreement (as per 'Form F-18A') (both in Original)
(g) Power of Attorney for authorized signatory in non-judicial stamp paper (as per 'Form F-24')
(h) Copy of Board Resolution
(i) 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 as Programmed File Attachments during online Bid Submission as a part of First envelope.

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

5.2 Soft Copy

Soft copy of the bid shall comprise of following documents to be uploaded on the TCIL portal ***https://www.tcil-india-electronictender.com*** as per provisions therein.

(A) As part of First Envelope (Online Only)

I. The Electronic Form of the bid for First Envelope (Techno-Commercial), as available on the TCIL portal, shall be duly filled.

II. Programmed file - Attachments (as detailed against clause no. 11.I) and Bid Form for first envelope.

III. Certificate of Incorporation

IV. 'Bidder's General Information', as per 'Form F-1'.

V. Shareholding Certificate (as per 'Form F-23')

VI. 'No Deviation Confirmation', as per 'Form F-6'

VII. 'Bidder's Declaration regarding Banning, Liquidation etc.', as per 'Form F-7'

VIII. 'Bidders Experience as per 'Form F-13'

IX. E-Banking Format (as per 'Form F-19')

X. Documents in accordance with the "Qualifying Requirements (QR)" establishing the qualification

XI. 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

XII. Tender Document. (Only First and Last Pages of Original Tender Document duly sealed and signed/ digitally signed and all pages of amendments and clarifications to Tender Documents duly sealed and signed/ digitally signed by the Authorized Signatory).

(B) <u>As part of Second Envelope(Online Only)</u>

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

(b) Main Price 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 No. 5.2 B for the definitions of Electronic Form and Main Bid), the price mentioned in the Main Bid (SOR) 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 Executing Agency.

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

There is an additional protection with SSL Encryption during transit from the client-end computer of a Supplier organization to the e-tendering server/ portal.

5.4 Other Instructions

For further instructions, the vendor should visit the home-page of the portal ***https://www.tcil-india-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 SIX CRITICAL DO'S AND DON'TS FOR BIDDERS

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

1. Obtain individual Digital Signing Certificate (DSC or DC) of Class II or above 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 users, assigning roles to them, etc.

3. Get your organization's concerned executives trained on ETS well in advance of your first tender submission deadline on ETS

4. Submit your bids well in advance of tender submission deadline on ETS (There could be last minute problems due to internet timeout, breakdown, etc)

5. 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, Executing Agency may ask for re-submission/ clarification for correct pass-phrase. If bidder fails to submit correct pass-phrase immediately as requested by Executing Agency, the Tender Processing Fee and Tender Document Fee, if applicable, shall be forfeited and bid shall not be opened, as EMD shall be refunded. No request on this account shall be entertained by Executing Agency/ Owner.

6. Bids will be made 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 and sixth 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:

i) Bidder may save/ store the bid documents in the PC/ Laptop before submitting the bid into in e-tender portal.

ii) 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 Priced Bid

The Priced Bid (i.e. Part II - Price Bid, refer ITB for details) to be uploaded using Link given under TCIL 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.

Executing Agency/ 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 TCIL’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 20 MB) at a time to facilitate easy uploading into e-tender portal. Executing Agency/ 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 TCIL'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 TCIL'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 band internet connectivity without Proxy settings is another option.

SECTION - III

BID DATA SHEETS (BDS)

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.	ITB 1.1	**The Executing Agency is:** **Solar Energy Corporation of India Limited,** D - 3, 1st Floor, Wing - A, Prius Platinum Building, District Centre, Saket, New Delhi - 110 017, India Kind Attn.: General Manager (C & P) / Manager (C & P) Telephone Nos.: - 0091-(0)11-71989256/71989290 Fax No.: - 0091-(0)11-71989243 E-mail: - **contracts@seci.co.in** **The Owner is:** Himachal renewable limited c/o Himachal Pradesh State Electricity Board Ltd Vidyut Bhawan Shimla Shimla, Himachal Pradesh – 171004 Kind Attn.: BRIJ MOHAN Sud Director (Technical) Telephone Nos.: 9418028701 E mail: brij1359@gmail.com
2.	ITB 1.2	The brief Scope of the Tender/ Work is: Design, Engineering, Supply, Construction, Erection, Testing, Commissioning and O&M of 2 MW (AC) Solar PV Power Plant with 01 MW BESS at KAZA, Himachal Pradesh
3.	ITB 3.0	Bids from Consortium/ Joint Venture: **Allowed**
4.	ITB 4.0	Number of Bids per Bidder: **Only 01 (One) Bid per bidder are allowed in the Tender Document.**
5.	ITB 15.0	Bid Validity: The bid validity period shall be 180 (One Hundred and Eighty Days) from the date of opening of Techno-Commercial Bid (Envelope-I).
6.	ITB 22.2	For hard copies of bid submission purpose, the address of the Executing Agency is: **Solar Energy Corporation of India Limited**,

Sl. No.	ITB Clause Ref. No.	Bid Data Details
		D - 3, 1st Floor, Wing - A, Prius Platinum Building, District Centre Saket, New Delhi - 110 017 Kind Attn.: General Manager (C & P) / Manager (C & P) Telephone Nos.: - 0091-(0)11-71989256/ 71989290 Fax No.: - 0091-(0)11-71989243 E-mail: - **contracts@seci.co.in**
7.	ITB 26.1	The bid opening shall take place at: **Solar Energy Corporation of India Limited**, D - 3, 1st Floor, Wing - A, Prius Platinum Building, District Centre Saket, New Delhi - 110 017
8.	ITB 35	Award of Contract: Subject to "ITB: Clause-29", the Owner, “Himachal renewable limited” award the Contract 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.
9.	ITB 36.1	Prior to the expiry of 'Period of Bid Validity', Executing Agency, Solar Energy Corporation of India Limited, New Delhi will notify the Owner/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
10.	ITB 37.1	State of which stamp paper is required for Contract Agreement: **Himachal Pradesh**

ANNEXURE TO BID DATA SHEET (BDS)

QUALIFYING REQUIREMENTS

QUALIFYING REQUIREMENTS (QR)

Qualification of the bidder(s) will be based on meeting the minimum eligibility criteria specified below regarding the Bidder's General Standards, Technical Experience and Financial Position as demonstrated by the Bidder's responses in the corresponding Bid documents. The bid can be submitted by an individual firm or by a Joint Venture of two or more firms. (Specific requirements for Joint Ventures are given under Para 1.4 below).

1.1 GENERAL ELIGIBILITY CONDITIONS

The Bidder should be a body incorporated in India under the Companies Act, 1956 or 2013 including any amendment thereto, Government owned Enterprises who are registered and incorporated in India, Limited Liability Partnership Firms, engaged in the business of Power/ Infrastructure barring Government Department as well as those firms against whom sanction for conducting business is imposed by Government of India and barring those firms with whom business is banned by the Owner/ SECI.

Proprietorship Firms, Partnership Firms, NGOs, Charitable Trusts, Educational Societies are not allowed to participate in the bidding process (either individually or in Joint Venture/ Consortium). The Bid Processing Fees and EMD are exempted for MSME Vendors/ Developers registered under NSIC/ DIC/ Udyog Aadhaar Category only. As the Proprietorship Firms, Partnership Firms, NGOs, Charitable Trusts, Educational Societies in any form are not allowed to participate in the tendering process, hence forth any Proprietorship Firms, Partnership Firms, 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)

1.1.1 In case the Bidder wishes to incorporate a Project Company, in such case Bidder if selected as a Successful Bidder can incorporate a Project Company. Bidder shall be responsible to get all clearance required/ obtained in the name of the Bidding Company transferred in the name of the Project Company.

1.1.2 The aggregate equity share holding of the Successful Bidder in the issued and paid up equity share capital of the Project Company shall not be less than fifty-one percent (51%) up to a period of One (01) year from the date of operational acceptance of the entire Sanctioned Capacity of the Project Developer.

1.1.3 Affiliation 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 the ownership by one company of more than 50% (Fifty Percent) of the voting rights of the other company or right to appoint majority Directors.

1.2 TECHNICAL ELIGIBILITY CONDITIONS

The bidder should have experience in development of Grid Connected Solar Projects on Turnkey basis including Design, Supply, Installation and Commissioning of Grid Connected Solar PV Power Plant and Solar Systems of cumulative Capacity not less than 0**1 (One) MW** in last Seven Financial years as on last date of bid submission. However, such Solar PV Power

Plant and Solar Systems capacity must have been in satisfactory operation as on the last date of bid submission for at least six (06) months from the date of commissioning.

AND

The bidder should have experience in development of Grid Connected Solar Projects on Turnkey basis including Design, Supply, Installation & Commissioning of at least 02 (Two) Grid connected Solar PV Power Plant Project having an individual capacities of **200 (Two Hundred) kW or above** in last Seven Financial years and till last date of bid submission. However, such Solar PV Power Plant and Solar Systems capacity must have been in satisfactory operation as on the last date of bid submission for at least six (06) months from the date of commissioning.

AND

The bidder should have experience of having successfully completed Design, Engineering, Supply, Installation, Testing & Commissioning of at least 03 (Three) Grid connected Battery Energy Storage Systems (BESS) having an individual capacities of **250 (Two Hundred Fifty) kWh or above** in last Five Financial years and till last date of bid submission. However, such BESS Plant capacity must have been in satisfactory operation as on the last date of bid submission for at least six (06) months from the date of commissioning.

If the BESS provider is participating as a subcontractor to the bidder then the Bidder shall submit the list of proposed BESS makes they intend to provide along with the submission of Technical documents, also with the credentials for all those makes and all such mentioned makes shall satisfy the Qualification requirements mentioned in the bidding document. During the execution of the Project, the supplied make of the BESS by the bidder shall have to be mandatorily among the list of makes submitted by the bidder during the Techno commercial stage.

If the BESS provider is participating as a subcontractor to the bidder then the Bidder shall be required to establish subcontracting agreement with the BESS supplier in the format as provided by the Owner within 90 days from the effective date of the Contract Agreement. Further, any delay beyond 90 (Ninety) days in signing of the subcontracting agreement as mentioned above, shall attract interest @ 1.25% as penalty per month on the total price of the BESS Plant (Supply) as mentioned under Schedule No 1/ Schedule No 2, calculated on pro-rata basis accordingly.

The list of projects commissioned at least 6 months prior to 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/ Owner shall be submitted in support of Clause 1.2 above.

The Performance Certificate must be issued minimum six (06) months from the date of commissioning. The Performance Certificate/ Joint meter reading (JMR) reports shall be issued from any state/ central owned agencies or state power departments or authorized representative of Power Offtaker (DISCOM/ Private Power purchaser).

The Bidder shall furnish copies of the following documents along with the Bid in support of meeting the above mentioned BEC:

a. Certificate of incorporation and MoA/ AoA in support of 1.1 above

Note: Except BESS, 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.

1.3 FINANCIAL ELIGIBILITY CONDITIONS

The Minimum Average Annual Turnover (MAAT) of the bidder in the last three financial years (i.e. FY 2015-2016, 2016-17 and 2017-18) should be **INR 7,20,00,000/- (Indian Rupees Seven Crores Twenty Lacs Only). In case the audited annual accounts for the year 2017-18 are not available with the bidder, Minimum Average Annual Turnover shall be considered for the average of its last three preceding years (i.e. FY 2014-15, 2015-2016, and 2016-2017).** ***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 turn over certified by a practicing CA/ Statutary Auditor should be compulsorily enclosed along with corresponding annual accounts.

AND

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

AND

The bidder should have a minimum Working Capital of **INR 3,00,00,000/- (Indian Rupees Three Crores 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 the availability of the line of credit for equal to or more than **INR 3,00,00,000/- (Indian Rupees Three Crores Only).**

1.3.1 **Void**

1.3.2 In case the bidder is a holding company, the financial position criteria referred to in clause 1.3 above shall be of that holding company only (i.e. excluding its subsidiary/ group companies). In case bidder is a subsidiary of a holding company, financial position criteria referred to in clause 1.3 above shall be of that subsidiary company only (i.e. excluding its holding company).

1.3.4 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.

1.3.5 The Net Worth of the Bidder as on the last day of the preceding financial year shall not be less than total paid-up share capital.

1.3.6 **Void**

1.3.7 **Void**

1.3.8 The derivation of Net Worth" of the Bidder shall be done as per Company Act 2013.

1.3.9 Other income shall not be considered for arriving at annual turnover.

1.3.10 A scanned copy of certificate of incorporation shall be furnished in the bid (through online mode).

1.3.11 Bidders shall furnish documentary evidence as per the prescribed format (online as well as offline), duly certified by Authorized Signatory and the Statutory Auditor/ Practicing Chartered Accountant of the Bidding Company in support of their financial capability.

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 Criteria. In case of tenders having the bid due date up to 30th September of the relevant financial year and audited financial results of immediate 3 preceding financial year being not available, the bidder has an option to submit the audited financial results of three years immediately prior to relevant financial year. Wherever, the bid due date is after 30th September of the relevant financial year, bidder has to compulsorily submit the audited financial results of immediate preceding three financial years.

1.4 JOINT VENTURE CONDITIONS

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

1.4.1 There can be a maximum of 03 (Three) partners in a JV/ Consortium. The Lead partner 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 must meet collectively 100% Financial Eligibility Conditions given at para 1.3 above, wherein a minimum of 20% Financial Eligibility should be met individually by all other partners of the JV/ Consortium. **JV/ Consortium members can be partner to the single JV/ Consortium arrangement only and they shall not be allowed to participate in multiple JV/ Consortium arrangements, wherein the same member is actually participating in multiple number of JVs/ Consortiums**.

1.4.2 All the partners of the JV/ Consortium must meet collectively 100% of Technical Eligibility Conditions given at para 1.2 above.

1.4.3 The JV/ Consortium must satisfy collectively the Criterion of Clauses 1.2 & 1.3 above for which purpose the relevant figure of Minimum Average Annual Turnover and Liquid Assets/ Credit Facilities for each of the partners of the JV/ Consortium shall be added together to arrive at JV/ Consortium total capacity. **The net worth of each Partner of JV/ Consortium should be positive.**

1.4.4 A Joint Venture (JV), may or may not be incorporated as a Registered Company.

1.4.5 A Joint Venture (JV), if incorporated as a Registered Company, is required to submit EMD and Performance Security in the name of Joint Venture only. In case of Consortium or a JV has not formed a Registered Company, the EMD and Performance Security shall be submitted in the name of Lead Partner only.

1.4.6 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). 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).

1.4.7 JV/ Consortium is also required to declare detailed scope of work to be executed by each partner of JV.

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 work/manufacturing facilities visit, (iii) manufacturing capacity, 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, manufacturing and testing facilities, manpower and financial resources, (v) details of quality systems in place, (vi) past experience and performance, (vii) customer feedback, (viii) banker's feedback etc.

1.4.8 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/ DIC/ Udyog Aadhaar Category only.

Employer/ Owner reserves the right to waive minor deviations if they do not materially affect the capability of the Bidder to perform the contract.

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 Executing Agency/ Owner and Bidders/ Contractors shall be governed by the Tender Documents/ Contracts signed between the Executing Agency/ Owner and the Contractor for the respective package(s). 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 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 Jammu & Kashmir 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 Executing Agency/Owner and the Contractor.

1.1.2 **AFFILIATE** shall mean a company that either directly or indirectly

a. controls or
b. is controlled by or
c. is under common control with

a Bidding Company and “control” means ownership by one company of at least Fifty percent (50%) of the voting rights of the other company.

1.1.3 **AFFECTED PARTY** means Executing Agency/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 Executing Agency/ Owner.

1.1.7 **ASSOCIATE** means a party who has been conjoined by the Contractor to independently execute a pre-selected part of facilities of the Contract and grant him the associated Contractual rights and obligations, without diluting the overall responsibility of the Contractor in respect of the Facilities under the Contract.

1.1.8 **ARBITRATOR** means the person or persons appointed by agreement between the Executing Agency/Owner and the Contractor to make a decision on or to settle any dispute or difference between the Executing Agency/Owner and the Contractor referred to him or her by the parties.

1.1.9 **BESS**. Battery Energy Storage System

1.1.10 **B.I.S.** means specifications of Bureau of Indian Standards (BIS).

1.1.11 **BID** means the Techno Commercial and 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.

1.1.12 **BID CAPACITY** means the capacity offered by the bidder in his Bid under Tender Document.

1.1.13 **BIDDER** means Bidding Company/ Expert submitting the Bid. Any reference to the Bidder includes Bidding Company/ Experts including its successors, executors and permitted assigns as the context may require.

1.1.14 **CAPACITY UTILIZATION FACTOR (CUF)** means the ratio of the actual output from a solar plant over the year (kWh) to the maximum possible output from it for a year (kWh) under ideal conditions.

CUF = Actual Plant Output in kWh over the year / (Installed Plant Capacity in kW x 365 x 24).
Monthly CUF = Monthly Plant output in kWh / (installed plant capacity in kW x number of days in a month x 24).

1.1.15 **CEA** means the Central Electricity Authority.

1.1.16 **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.

1.1.17 **COLLABORATOR** or **PARENT COMPANY** means the firms/ corporations who has provided technological support to the manufacturer for establishing production line for the specific Equipment.

1.1.18 **COMPANY** means a body incorporated in India under the Companies Act, 1956 or Companies Act, 2013 including any amendment thereto.

1.1.19 **CONTRACT** shall mean the Agreement between the Executing Agency/ Owner and the Contractor for the execution of the works including therein all Contract documents.

1.1.20 **CONTRACTOR/ SUCCESSFUL BIDDER/ PROJECT DEVELOPER** means the person or the persons, Company or Corporation whose Tender has been accepted by the Executing Agency/ Owner and includes the Contractor's legal representatives his/ her successors and permitted assigns.

1.1.21 **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.

1.1.22 **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.

1.1.23 **CONTRACTOR'S REPRESENTATIVE** means any person nominated by the Contractor and approved by the Executing Agency/Owner to perform the duties delegated by the Contractor.

1.1.24 **CONSULTANT** means Techno-Commercial experts who are the consulting engineer to the Executing Agency/ Owner for this project.

1.1.25 **CONSTRUCTION EQUIPMENT** means all appliances/ equipment and things whatsoever nature for the use in or for the execution, completion, operation, or maintenance of the work or temporary works (as here in after defined) but does not include materials or other things intended to form or to be incorporated into the work, or camping facilities.

1.1.26 **COMMISSIONING** shall mean pressing into service/ operation of the system including the plant(s), equipment(s), machinery (ies), or any other section or sub-section of installation(s) pertaining to the

work of the Contractor after successful testing and trial runs of the same. Commissioning can be either for a completed system or a part of system of a combination of systems or sub-systems and can be performed in any sequence as desired by Executing Agency/ Owner and in a manner established to be made suited according to availability of pre-requisites. Any such readjustments made by Executing Agency/ Owner in performance of Commissioning activity will not be construed to be violating Contract provisions and Contractor shall be deemed to have provided for the same.

1.1.27 **COMPLETION** means that the Facilities have been completed operationally and structurally and put in a tight and clean condition and that all works in respect of pre-commissioning of the Facilities has been completed (wherever required, as per Technical Specifications) and Commissioning followed by Trial - Operation has been completed.

1.1.28 **COMPLETION CERTIFICATE** shall mean the certificate to be issued when the works have been completed entirely in accordance with Contract Documents.

1.1.29 **CONTROLLING OFFICER** means the authorized controlling person/ body of the Contract from respective department appointed by the Executing Agency/ Owner to perform the duties delegated by the Executing Agency/ Owner.

1.1.30 **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.

1.1.31 **DAY** means a day of 24 hours from midnight to midnight irrespective of the number of hours worked in that day.

1.1.32 **DEFECT LIABILITY PERIOD** in relation to a work/ supply means the specified period from the date of Completion Certificate/ date of receipt of material up to the date of issue of Final Certificate during which the Contractor/ Supplier 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.

1.1.33 **DRAWINGS** shall include maps, plans and tracings 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.

1.1.34 **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.

1.1.35 **EXECUTING AGENCY** means the Company/ Corporation/ Government Entity, named in the **BDS/ SCC**, who is responsible for getting the Facilities implemented. The Executing Agency may be Owner himself or an agency appointed by the Owner and shall include the legal successors or permitted assigns of the Executing Agency.

1.1.36 **ENGINEER/ ENGINEER-IN-CHARGE** shall mean the person designated from time to time by the Executing Agency/ Owner and shall include those who are expressly authorized by him to act for and on his behalf for operation of this Contract.

1.1.37 **EFFECTIVE DATE** means the date of issuance of Notification of Award/ Letter of Intent/ Letter of Allocation from which the Time for Completion shall be determined.

1.1.38 **EVALUATED BID VALUE (EBV)** means the Evaluated Price derived from the schedule of rates (SOR) as per Section VIII of Tender document.

1.1.39 **FACILITY(IES)** means the Plant and Equipment to be supplied and installed, as well as all the Installation Services to be carried out by the Contractor under the Contract.

1.1.40 **FINAL CERTIFICATE** in relation to a work means the certificate regarding the satisfactory compliance of various provision of the Contract by the Contractor issued by the Engineer-in- Charge/ Executing Agency after the period of liability is over.

1.1.41 **FINAL ACCEPTANCE** means acceptance of Facilities by the Owner at the end of O&M period, as stated in this NIT, from the date of Commissioning or demonstration of minimum annual CUF whichever comes later which certifies the Contractor's fulfilment of the Contract in respect of Functional and Plant Performance Guarantees of the Facilities

1.1.42 **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.

1.1.43 **GOODS & SERVICE TAX (GST)** is an indirect tax throughout India to replace taxes levied by the central and state governments. Goods & Services Tax is a comprehensive, multi-stage, destination-based tax that will be levied on every value addition.

1.1.44 **IEC** means specifications of International Electro-Technical Commission.

1.1.45 **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, inspection, expediting, site preparation works (including the provision and use of Contractor's Equipment and the supply of all construction materials required), installation, testing, pre-commissioning, commissioning, operations, maintenance, the provision of operations and maintenance manuals, training, etc.

1.1.46 **MWp** means Mega-Watt Peak.

1.1.47 **kWh** shall mean Kilo-Watt-hour.

1.1.48 **LANGUAGE FOR DRAWINGS AND INSTRUCTION** All the drawings, titles, notes, instruction, dimensions, etc. shall be in English Language only.

1.1.49 **MNRE** means Ministry of New and Renewable Energy, Government of India.

1.1.50 **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/ Executing Agency/ Owner.

1.1.51 **NET-WORTH** shall have same meaning as defined in Company Act 2013 and Amendment, if any.

1.1.52 **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 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.

1.1.53 **NOTIFICATION OF AWARD (NOA)** means the official notice issued vide Letter/ E-mail by the Executing Agency/Owner notifying the Contractor that his bid has been awarded.

1.1.54 **NTP** means Notice to Proceed

1.1.55 **OPERATIONAL ACCEPTANCE** means the acceptance by the Executing Agency/Owner of the Facilities (or any part of the Facilities where the Contract provides for acceptance of the Facilities in parts), which certifies the Contractor's fulfilment of the Contract in respect of Functional Guarantees of the Facilities (or the relevant part thereof) after successful Commissioning followed by Trial - Operation.

1.1.56 **O & M** means Operation & Maintenance of Commissioned Project/ Work/ Facilities under the Tender.

1.1.57 **OWNER** means the Company/ Corporation/ Government Entity, named in the **BDS/ SCC**, who has decided to set up the Facilities and shall include the legal successors or permitted assigns of the Owner.

1.1.58 **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.

1.1.59 **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.

1.1.60 **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.

1.1.61 **PROJECT MANAGER/ OFFICER-IN-CHARGE** means the person appointed by the Executing Agency/ Owner to perform the duties delegated by the Executing Agency/ Owner.

1.1.62 **SCC** means the Special Conditions of Contract.

1.1.63 **SECI** means Solar Energy Corporation of India Limited, New Delhi (A Government of India Enterprise) under MNRE.

1.1.64 **SITE** means the land and other places upon which the Facilities are to be installed, and such other land or places as may be specified in the Contract as forming part of the Site.

1.1.65 **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 Executing Agency/ Owner 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.

1.1.66 **SUB-CONTRACTOR** means any person or firm or Company (other than the Principal Contractor) to whom any part of the work has been entrusted by the Principal Contractor, with the written consent of the Engineer-in-Charge/Project Manager.

1.1.67 **TAKING OVER** means the Executing Agency's/ Owner's written acceptance of the Facilities under the Contract, after successful Trial - Operation for the specified period in accordance with the Contract

1.1.68 **TEMPORARY WORKS** shall mean all temporary works of every kind required in or about the execution, completion or maintenance of works.

1.1.69 **TENDER** means the process whereby Executing Agency/ Owner invite bids for Projects/ Works/ Facilities that are submitted within a finite deadline by the Bidder/ Contractor.

1.1.70 **TENDER DOCUMENTS/ BIDDING DOCUMENTS** means the entire set of documents vide which Executing Agency/ Owner invite bids for Projects/ Works/ Facilities that are submitted within a finite deadline by the Bidder/ Contractor.

1.1.71 **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) and "Taking Over" by the Executing Agency/ Owner is to be attained.

1.1.72 **TOTAL CONTRACT PRICE/CONTRACT VALUE** means the sum accepted or the sum calculated in accordance with the prices accepted in Tender and/or the Contract rates as payable to the Contractor for the entire execution and full completion of the work, including change order.

1.1.73 **ULTIMATE PARENT COMPANY** shall mean a company which directly or indirectly owns at least Fifty percent (50%) paid up equity capital in the Bidding Company and/ or in the Financially Evaluated Entity and such Bidding Company and/ or the Financially Evaluated Entity shall be under the direct control or indirectly under the common control of such company.

1.1.74 **WEEK** means a period of any consecutive seven days.

1.1.75 **WORKING DAY** means any day which is not declared to be holiday or rest day by the Executing Agency/ Owner.

[B] GENERAL INFORMATIONS

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).

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 Executing Agency/ 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. 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 Executing Agency/ Owner at his discretion may endeavor to provide water to the Contractor at the Executing Agency's/ Owner's source of supply provided the Contractor makes his own arrangement for the water meter which shall be in custody of the Executing Agency/ Owner and other pipe networks from source of supply and such distribution pipe network shall have prior approval of the Engineer-in-Charge/Project Manager 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 Executing Agency/ 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, Executing Agency/ 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 Executing Agency/ 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 Executing Agency/ Owner which should be in the custody and control of the Executing Agency/ Owner. The cost of power supply shall be payable to the Executing Agency/ Owner by the contractor. The Executing Agency/ 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 Executing Agency/ 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 Executing Agency/ 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 Government Electricity Rules.

2.4.6 In case of damage of any of the Executing Agency's/ Owner's equipment on account of fault, intentional or unintentional on the part of the Contractor, the Executing Agency/ Owner reserves the right to recover the cost of such damage from the Contractor's bill. Cost of HRC Fuses replaced at the Executing Agency's/ Owner's terminals due to any fault in the Contractor's installation shall be to Contractor's account at the rates decided by the Engineer-in-Charge/Project Manager.

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

The Executing Agency/ 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 Executing Agency/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 Executing Agency/ 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 Executing Agency/ 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 Executing Agency/ 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 Executing Agency/ 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 paper 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 the names of Executing Agencys/ 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 Executing Agency/ Owner that, Executing Agency/ 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 Executing Agency/ 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 Executing Agency/Owner to Accept or Reject Tender

5.1 The right to accept the Tender will rest with the Executing Agency/ Owner. The Executing Agency/ 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 Executing Agency/ 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 Engineer-in- Charge and Contractor based on priority requirement of this project. 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.

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.

6.5 The progress report shall be in a form acceptable to the Project Manager/EIC and shall also indicate: (a) percentage completion achieved compared with the planned percentage completion for each

activity; and (b) where any activity is behind the program, giving comments and likely consequences and stating the corrective action being taken.

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 Executing Agency/Owner 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 Clause, or any extended period as may otherwise be agreed upon between the Executing Agency/Owner and the Contractor, Contractor shall submit the revised plan for completion of Facility accordingly.

6.7 Maintenance of Records of Weekly Progress Review Meeting at Site
The Contractor shall be required to attend all weekly site progress review meetings organized by the 'Project Manager/ EIC' or his authorized representative. The deliberations in the meetings shall inter-alia include the weekly 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 Executing Agency/Owner, delays, if any and recovery program, specific hindrances to work and work instructions by Executing Agency/Owner. The minutes of the weekly meetings shall be recorded in triplicate in a numbered register available with the 'Project Manager/ EIC' or his authorized representative. These recordings shall be jointly signed by the 'Project Manager/ EIC' or his authorized representative and the Contractor and one copy of the signed records shall be handed over to the Contractor.

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 Executing Agency/ 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 Executing Agency/ 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 Tenderers shall be deemed to have visited the Site and familiarized submitting the Tender. Non-familiarity with the site conditions will not be considered a reason either 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/ Central Government or of the Executing Agency/ 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 Executing Agency/ Owner without the previous permission of the Executing Agency/ 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 or of the Executing Agency/ Owner as aforesaid before submission of Tender, or engagement in the Contractor's service as the case may be.

9. Representatives and Field Management & Controlling/ Coordinating Authority

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 Owner/Executing Agency shall appoint and notify the Contractor in writing of the name of the Project Manager/ EIC. The Owner/Executing Agency 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 Owner/Executing Agency 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 Owner/Executing Agency at all times during the currency of the Contract. All notices, instructions, orders, certificates, approvals and all other communications under the Contract shall be given by the Project Manager/ EIC, except as herein otherwise provided.
All notices, instructions, information and other communications given by the Contractor to the Executing Agency 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 Owner/ Executing Agency in writing to approve the person so appointed. If the Owner/ Executing Agency makes no objection to the appointment within seven (07) days of submission, the Contractor’s Representative shall be deemed to have been approved. If the Executing Agency 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 clause 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/ Executing Agency 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 Owner/ Executing Agency prior written consent, which shall not be unreasonably withheld. If the Owner/ Executing Agency 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 Owner/ Executing Agency (which shall not be unreasonably withheld), at any time delegate to any person any of the powers, functions and authorities vested in him or her. Any such delegation may be revoked at any time. Any such delegation or revocation shall be subject to a prior notice signed by the Contractor's Representative, and shall specify the powers, functions and authorities thereby delegated or revoked. No such delegation or revocation shall take effect unless and until a copy thereof has been delivered to the Executing Agency and 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 Owner/ Executing Agency 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 Owner/ Executing Agency may by notice to the Contractor object to any representative or person employed by the Contractor in the execution of the Contract who, in the reasonable opinion of the Owner/ Executing Agency, may behave inappropriately, may be in- competent or negligent, or may commit a serious breach of the Site regulations and safety. The Executing Agency shall provide evidence of the same, whereupon the Contractor shall remove such person from the Facilities.

9.11 If any representative or person employed by the Contractor is removed in accordance with GCC Clause, the Contractor shall, where required, promptly appoint a replacement. The field management will be the responsibility of the Engineer-in-Charge/Project Manager, who will be nominated by the Executing Agency/ Owner. The Engineer-in-Charge/Project Manager may also authorize his representatives to assist in performing his duties and functions.

9.12 The Engineer-in-Charge/Project Manager shall coordinate the works of various agencies engaged at site to ensure minimum disruption of work carried out by different agencies. It shall be the responsibility of the Contractor to plan and execute the work strictly in accordance with site instructions to avoid hindrance to the work being executed by other agencies.

9.13 **Hindrance Register**

The Contractor may also maintain a Hindrance Register where reasons 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. Any exceptions taken by the bidder to the Schedule of Rates shall be brought out in the terms and conditions of the bid.

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 Executing Agency to the Bidder.

11.2 Zero Deviation: Bidders to note that this is a Zero Deviation Tender. Executing Agency/ Owner will appreciate submission of bids based on the terms and conditions in the enclosed General Conditions of 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 Executing Agency/ Owner or its employee(s) or its representatives shall not in any way be binding on Executing Agency/ Owner.

13. Local Conditions

13.1 It will be imperative on each bidder to inform himself of all local 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 and other related Acts and Laws and Regulations of India with their latest amendments, as applicable Executing Agency/ Owner 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. No claim for financial or any other adjustments to Value of Contract, on lack of clarity of such factors shall be entertained.

14. Extension of Time for Completion

14.1 The Time(s) for Completion 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 by reason of any of the following:

14.1.1 Any occurrence of Force Majeure as provided in the Tender for Force Majeure, unforeseen/ differed site conditions (Unforeseen/ differed site Conditions).

14.1.2 Any changes in laws and regulations as provided in GCC (Change in Laws and Regulations) or by such period as shall be fair and reasonable in all the circumstances and as shall fairly reflect the delay or impediment sustained by the Contractor.

14.2 Except where otherwise specifically provided in the Contract, the Contractor shall submit to the Project Manager a notice of a claim for an extension of the Time for Completion, together with particulars of the event or circumstance justifying such extension as soon as reasonably practicable after the commencement of such event or circumstance. As soon as reasonably practicable after

receipt of such notice and supporting particulars of the claim, the Executing Agency/Owner and the Contractor shall agree upon the period of such extension. In the event that the Contractor does not accept the Executing Agency's/Owner's estimate of a fair and reasonable time extension, then the matter will be settled in accordance with the provisions of GCC Clause (Adjudicator).

14.3 The Contractor shall at all times use its reasonable efforts to minimize any delay in the Performance of its obligations under the Contract.

14.4 The Contractor shall be required to attend all weekly site progress review meetings organized by the 'Project Manager' or his authorized representative. The deliberations in the meetings shall include the weekly program, progress of work (including details of manpower, tools and plants deployed by the Contractor vis-à-vis agreed schedule), inputs to be provided by Executing Agency/Owner, delays, if any and recovery program, specific hindrances to work and work instructions by Executing Agency/Owner. The minutes of the weekly meetings shall be recorded in triplicate in a numbered register available with the 'Project Manager' or his authorized representative. These recordings shall be jointly signed by the 'Project Manager' or his authorized representative and the Contractor and one copy of the signed records shall be handed over to the Contractor.

[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:

1) The Contract Agreement and any change order in the CA. if any;
2) The Notification of Award/ Letter of Intent/ Letter of Allocation;
3) Special Conditions of Contract (SCC);
4) Bid Data Sheet (BDS) and Instructions to Bidders (ITB);
5) General Conditions of Contract (GCC);
6) Any other document forming part of the Contract.

Works shown in the Drawing but not mentioned in the Specifications or described in the Specifications without being shown in the Drawings shall nevertheless be deemed to be included in the same manner as if they had been specifically shown upon the Drawings and described in the Specifications.

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 rate 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 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 schedules rates and to have satisfied himself to the sufficiency of his tender. 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, Customs duty 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 Contract Document he shall set forth the particulars thereof in writing to Executing Agency/Owner in duplicate, before submission of tender. The Executing Agency/Owner may provide such clarification as may be necessary in writing to Contract, such clarifications as provided by Executing Agency/Owner shall form part of Contract Documents. No verbal agreement or inference from conversation with any effect or employee of the Executing Agency/Owner 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 Contract shall be commenced immediately upon issuance of the NOA/ LOI/ LOA and be completed in stages 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 opened will not receive 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 jointly with the Engineer-in-Charge/Project Manager. 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 testing, rectifications, if any, retesting and completion in all respects in accordance with Contract Document to the entire satisfaction of the Engineer-in-Charge/Project Manager.

18.2.2 The Contractor shall submit a detailed PERT network within the time frame agreed 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 interface facilities to be provided by the Executing Agency/ Owner, 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:
  - Negligent or intentional acts, errors or omissions;
  - Failure to comply with an Indian Law; or
  - Breach of, or default under this Contract Agreement.
- Normal rainy seasons and monsoon

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 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 Executing Agency/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 of Plant in accordance with SCC Clause for the whole of the facilities, (or a part for which a separate time for completion is agreed) then the Contractor shall pay to the Executing Agency/ Owner a sum equivalent to one percent (1%) of the Contract Price for the whole of the facilities, (or a part for which a separate time for completion is agreed) as liquidated damages for such default and not as a penalty, without prejudice to the Executing Agency's/ Owner's other remedies under the Contract, for each week or part thereof which shall elapse between the relevant Time for Completion and the date stated in Taking Over Certificate of the whole of the Works (or a part for which a separate time for completion is agreed) subject to the limit of ten percent (10%) of Contract Price for the whole of the facilities, (or a part for which a separate time for completion is agreed). The Executing Agency/ 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, Executing Agency/ Owner may consider the termination of contract. Any

such recovery on account of the Liquidated damages can be done from the running bills of the contractor by Owner.

20.2 The Executing Agency/ Owner shall 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 Executing Agency/ 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 Executing Agency/ Owner may by giving (01) one month notice to the Contractor cancel the Contract without prejudice to the Executing Agency's/ Owner's right under Clauses 20.1 and 20.2 any other provisions contained in the Contract to determine the Contract and claim damaged from the Contractor.

20.4 The Contractor shall not raise the question of proving actual loss suffered by the Executing Agency/ Owner consequent on the said delay in Completion.

21. Rights of the Executing Agency to forfeit Contract Performance Security

21.1 Whenever any claim against the Contractor for the payment of a sum of money arises out or under the Contract, the Executing Agency/ Owner shall be entitled to recover such sum by appropriating in part or whole 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 the case may be shall be deducted from any sum then due or which at any time thereafter may become due to the Contractor. The Contractor shall pay to the Executing Agency/ Owner on demand any balance remaining due.

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 or extension thereof or fails to perform any of his obligation under the Contract or in any manner commits a breach of any of the provisions of the Contract it shall be open to the Executing Agency/ Owner at its option by written notice to the Contractor:

a) To determine the event in which the Contract shall stand terminated and shall cease to be in force and effect on and from the date appointed by the Executing Agency/ Owner on that behalf, whereupon the Contractor shall stop forthwith any of the Contractor's work then in progress, except such work as the Executing Agency/ Owner may, in writing, require to be done to safeguard any property or work, or installations from damage, and the Executing Agency/ Owner, for its part, may take over the work remaining unfinished by the Contractor and complete the same through a fresh Contractor or by other means, at the risk and cost of the Contractor, and any of his sureties if any, shall be liable to the Executing Agency/ Owner for any excess cost occasioned by such work having to be so taken over and completed by the Executing Agency/ Owner over and above the cost at the rates specified in the schedule of quantities and rate/prices.

b) Without determining the Contract to take over the work of the Contractor or any part thereof and complete the same through a fresh Contractor or by other means at the risk and cost of the Contractor. The Contractor and any of his sureties are liable to the Executing Agency/ Owner for any excess cost over and above the cost at the rates specified in the Schedule of Rates/ Price Schedule, occasioned by such works having been taken over and completed by the Executing Agency/ Owner.

22.2 In such events of Clause 22.1(a) or (b) 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 Executing Agency/ Owner to recover from the Contractor the excess cost referred to in the Clause aforesaid, the Executing Agency/ 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.

b) The amount that may have become due to the Contractor on account of work already executed by him shall not be payable to him until after the expiry of 06 (Six) calendar months reckoned from the date of termination of Contract or from the taking over of the Work or part thereof by the Executing Agency/ Owner as the case may be, during which period the responsibility for faulty materials or workmanship in respect of such work shall, under the Contract, rest exclusively with the Contractor. This amount shall be subject to deduction of any amounts due from the Contract to the Executing Agency/ Owner under the terms of the Contract authorized or required to be reserved or retained by the Executing Agency/ Owner.

22.3 Before determining the Contract as per Clause 22.1(a) or (b) provided in the judgement of the Executing Agency/ 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 Executing Agency/ Owner may issue Notice in writing calling the Contractor to cure the default within such time specified in the Notice.

22.4 The Executing Agency/ Owner shall also have the right to proceed or take action as per 22.1(a) or (b) 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 not be necessary for the Executing Agency/ Owner to give any prior notice to the Contractor.

22.5 Termination of the Contract as provided for in sub- clause 22.1(a) above shall not prejudice or affect their rights of the Executing Agency/ Owner which may have accrued up to the date of such termination.

23. Contractor remains liable to pay compensation if

23.1 In any case in which any of the powers conferred upon the Executing Agency/ 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. In the event of the Executing Agency/ Owner putting in force the power under above Clause (a), (b) or (c) vested in him under the preceding clause he may, if he so desired, take possession of all or any tools, and plants, materials and stores in or upon the works or the site thereof belonging to the Contractor or procured by him and intended to be used for the execution of the Work or any part thereof paying or allowing for the same in account at the Contract rates or in case of these not being applicable at current market rates to be certified by the Engineer-in-Charge/Project Manager whose certificate thereof shall be final, otherwise the Engineer-in- Charge may give notice in writing to the Contractor or his clerk of the works, foreman or other authorized agent, requiring him to remove such tools, plant, materials or stores from the premises (within a time to be specified in such notice), and in the event of the Contractor failing to comply with any such requisition, the Engineer-in-Charge/Project Manager may remove them at the Contractor's expense or sell them by auction or private sale on account of the Contractor and at his risk in all respects without any further notice as to the date, time or place of sale and the certificate of the Engineer-in-Charge/Project Manager as to the expenses of any such

removal and the amount of the proceeds and expenses of any such sale shall be final and conclusive against the Contractor.

24. Change in Constitution

24.1 The prior approval of the Executing Agency/ Owner shall be obtained in writing, before any change is made in the constitution of the Company. If prior approval as aforesaid is not obtained, the CONTRACT shall be deemed to have been allotted in contravention of Clause 30 hereof and the same action may be taken and the same consequence shall ensure as provided in the said clause.

25. Termination of contract

25.1 **Termination of Contract in Case of Liquidation/ Bankruptcy etc**.

If the Contractor shall dissolve or become bankrupt or insolvent or cause or suffer any receiver to be appointed of his business of any assets thereof compound with his Creditors, or being a corporation commence to be wound up, not being a member's voluntary winding up for the purpose of amalgamation or reconstruction, or carry on its business under a Receiver for the benefits of its Creditors any of them, Executing Agency/ Owner shall be at liberty :- To terminate the contract forthwith upon coming to know of the happening of any such event as aforesaid by notice in writing to the Contractor or to give the Receiver or liquidator or other person, the option of carrying out the contract subject to his providing a guarantee up to an amount to be agreed upon by Executing Agency/ Owner for due and faithful performance of the contract.

25.2 **Termination of Contract for Non-Performance and Subsequently Putting the Contractor on Banning List:**

In case of termination of Contract herein set forth (under clause 22.0) except under conditions of Force Majeure and termination after expiry of contract, the Contractor shall be put under Banning List [i.e. neither any enquiry will be issued to the party by Executing Agency/ Owner against any type of tender nor their offer will be considered by Executing Agency/ Owner against any ongoing tender(s) where contract between Executing Agency/ Owner and that particular Contractor (as a bidder) has not been finalized] for a period as decided by the Executing Agency/ Owner to such Contractor**.**

26. Members of the Executing Agency/ Owner not individually Liable

26.1 No Director, or official or employee of the Executing Agency/ 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. Executing Agency/Owner not bound by Personal Representations

27.1 The Contractor shall not be entitled to any increase on the scheduled rates 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

28.1 The Contractor shall provide and maintain an office at the site for the accommodation of his agent and staff and such office shall be open at all reasonable hours to receive instructions, notice or other communications. The Contractor at all time shall maintain a site instruction book and compliance of these shall be communicated to the Engineer-in-Charge/Project Manager from time to time and the whole document to be preserved and handed over after completion of works.

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 to the satisfaction of the Engineer-in-Charge/Project Manager 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 comprised 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 to the satisfaction of the Engineer-in-Charge/Project Manager 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 shall in the opinion of Engineer-in-Charge/Project Manager be guilty of any misconduct or be incompetent or insufficiently qualified or negligent in the performance of their duties of that in the opinion of the Executing Agency/ Owner or the Engineer-in-Charge/Project Manager, it is undesirable for administrative or any other reason for such person or persons to be employed in the works, the Contractor, is so directed by the Engineer-in-Charge/Project Manager, 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 without the written permission of the Engineer-in-Charge/Project Manager. Any person so removed from the Work shall be immediately re-placed 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 Executing Agency/ Owner of all consequent claims or actions for damages or injury or any other grounds whatsoever. The decision of the Engineer-in-Charge/Project Manager upon any matter arising under this clause shall be final. The Contractor shall be liable for any liability to Executing Agency/ 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 Executing Agency/ Owner and Contractor's personnel entering upon the Executing Agency's/ Owner's premises shall be properly identified by badges of a type acceptable to the Executing Agency/ Owner which must be worn at all times on Executing Agency's/ Owner's premises. Contractor may be required to obtain daily entry passes for his Staff/ Employees from Executing Agency/ Owner to work within operating areas. These being safety requirements, no relaxations on this account shall be given to Contractor.

30. Sub-letting of Works

30.1 No 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 Executing Agency/ Owner except as provided for in the succeeding Clause.

i) **Sub-Contracts for Temporary Works etc**.

The Executing Agency/ Owner 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 submitted to the Engineer-in-Charge/Project Manager before being entered into and is approved by him.

ii) **List of Sub-Contractors to be supplied**

At the commencement of every month 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) **Executing Agency/Owner May Terminate Sub-Contracts**

If any Sub-Contractor engaged upon the works at the site executes any works which in the opinion of the Engineer-in-Charge/Project Manager is not in accordance with the Contract documents, the Executing Agency/ Owner may by written notice to the Contractor request him to terminate such subcontract and the Contractor upon the receipt of such notice shall terminate such Subcontract and dismiss the Sub-Contractor(s) and the later shall forthwith leave the works, failing which the Executing Agency/ Owner shall have the right to remove such Sub-Contractor(s) from the site.

v) **No Remedy for Action Taken under this Clause**

No action taken by the Executing Agency/ 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 Executing Agency/ Owner shall have the right to remove such Sub-Contractor(s) from the site.

vi) **Termination/ Cancellation of Contract**

Executing Agency/ 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. In case of non-performance of the sub-contractor in lieu of inadequate liquidity, technical competence, adequate manpower Executing Agency/ Owner may take an appropriate decision to get the work done at the risk and cost of the principal contractor.

Subject to poor performance and prolonged delay of the project on account of inefficient sub-letting of the project work Executing Agency/ 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.

The Contractor has to execute the work by functioning like a contractor instead of sub-letting the entire work on back to back basis. The entire work cannot be sub-let to a sub-contractor on back to back basis.

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 Subcontractors engaged by the Contractor in connection with the Performance of the Contract shall be under the complete control of the Contractor and shall not be deemed to be employees of the Owner/Executing Agency. Nothing contained in the Contract or in any subcontract awarded by the Contractor shall be construed to create any contractual relationship between any such employees, representatives or Subcontractors and the Executing Agency.

viii) Under no circumstances the sub-contractor shall claim or shall put any binding to the Owner/Executing Agency and at all times the sub-contractor must be managed by the Contractor. The Owner/ Executing Agency 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.

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 Work or the Work for a period of 14 (Fourteen) days without authority from the Engineer-in-Charge/Project Manager, or
iv) fail to carry out and execute the Work to the satisfaction of the Engineer-in-Charge/Project Manager, or
v) fail to supply sufficient or suitable construction plant, temporary works, labour, materials or things, or
vi) 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
vii) if the Contractor abandon the Work, or
viii) If the Contractor during the continuance of the Contract shall become bankrupt, make any arrangement or composition with his creditors, or permit any execution to be levied 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 Executing Agency/ Owner shall have the power to enter upon the Work 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 relate the same upon any terms and to such other person, firm or corporation as the Executing Agency/ 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 Executing Agency/ 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 as certified by the Engineer-in-Charge/Project Manager 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 Executing Agency/ Owner by the Contractor and the Executing Agency/ Owner shall have power to sell in such manner and for such price as he may think fit all or any of the construction plant, materials etc. constructed by or belonging to and to recoup and retain the said deficiency or any part thereof out of proceeds of the sale.

32. Contractor's responsibility with the Mechanical, Electrical, Intercommunication System, Air-Conditioning Contractors and other Agencies

32.1 Contractor’s responsibility

32.1.1 The Contractor shall grade/level the land identified for development of the mentioned Solar power Plant (with cells & modules manufactured in India) 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 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 Contractor confirms that it has entered into this Contract on the basis of proper examination of the data relating to the Facilities provided by the c and assessed by himself at the site location, after proper due diligence relating to the Facilities prior to bid submission. The Contractor acknowledges that any failure to obtain or acquaint itself with all such data and information shall not relieve its responsibility for properly estimating the difficulty or cost of successfully performing the Scope of Work.

32.1.3 The Contractor shall acquire, on behalf of Owner/Executing Agency, in the Owner’s/Executing Agencys’ 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 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/Executing Agency’s Equipment (if any). In this regard, any document required from Owner/ Executing Agency 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 approvals, permits, licenses, certificates and other relevant document generated as a result of the setting up of project and O&M process to the Owner.

32.1.4 In the matter of connectivity of Plant to DISCOM’s substation, Owner/ Executing Agency shall fill up the application & hand it over to the contractor however all other activities beyond it such as coordination with DISCOM for Bay allocation, technical/regulatory compliance for interconnection including payment of Fee or any other charges to the state agencies/DIOSCOM as the case may be shall be taken care by the Contractor. Bidders are advised to include these cost in their final offer/Price BID.

32.1.5 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 Subcontractor's personnel and entry permits for all imported Contractor's Equipment. The Contractor shall acquire all other permits, approvals and/or licenses that are not the responsibility of the Owner/ Executing Agency and that are necessary for the Performance of the Contract.

32.1.6 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/ Executing Agency. However, all the documents required from Executing Agency, as needed for the process, will be provided by Owner/ Executing Agency. The demand of such documents shall be made to the Owner/ Executing Agency in at least 10 days advance.

32.1.7 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 or other laws that affect the Performance of the Contract and binding upon the Contractor. The Contractor shall indemnify and hold harmless the Executing Agency/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.

32.1.8 Any plant, material, spares & spares inventory and services that will be incorporated in or be required for the facilities and other supplies shall have their origin.

32.1.9 Unless otherwise specified in the Contract or agreed upon by the Owner/ Executing Agency and the Contractor, the Contractor shall provide/ deploy sufficient, properly qualified operating and maintenance personnel; shall supply and make available all raw materials, spares, 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/ Executing Agency" 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/ Executing Agency and the Contractor.

32.1.10 Without repugnance of any other condition, it shall be the responsibility of the Contractor executing the work of civil construction, to work in close cooperation and coordinate the Work with the Mechanical, Electrical and Intercommunication Contractor's and other agencies or their authorized representatives, in providing the necessary grooves, recesses, cuts and opening etc., in wall, slabs beams and columns etc. and making good the same to the desired finish as per specification, for the placement of electrical, intercommunication cables, conduits and other equipment's etc. where required. For the above said requirements in the false ceiling and other partitions, the Contractor before starting-up the work shall in consultation with the Electrical, Mechanical, Intercommunication, and other agencies prepare and put-up a joint scheme, showing the necessary openings, grooves, recesses, cuts, the methods of fixing required for the Work of the aforesaid, and the finishes therein, to the Engineer-in-Charge/Project Manager and get the approval. The Contractor before finally submitting the scheme to the Engineer-in-Charge/Project Manager, shall have the written agreement of the other agencies. The Engineer- in-Charge, before communicating his approval to the scheme, with any required modification, shall get the final agreement of all the agencies, which shall be binding. No claim shall be entertained on account of the above. The Contractor shall confirm in all respects with provision of any statutory regulations, ordinances or byelaws of any local or duly constituted authorities or public bodies which may be applicable from time to time to the Work or any temporary works. The Contractor shall keep the Executing Agency/ Owner indemnified against all penalties and liabilities of every kind, arising out of non- adherence to such stains, ordinances, laws, rules, regulations, etc.

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.

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 by registered mail direct to the address furnished by the Contractor. Proof of issue of any such notice could be conclusive of the Contractor having been duly informed of all contents therein.

34.2 To the Executing Agency/ Owner

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

35. Right of Various Interests

35.1 **i)** The Executing Agency/ 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 Executing Agency/ Owner or by other agency(ies) employed by the Executing Agency/ Owner is contingent upon Work covered by this Contract, the respective rights of the various interests involved shall be determined by the Engineer-in-Charge/Project Manager to secure the completion of the various portions of the work in general harmony.

36. Patents and Royalties

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

The Contractor shall indemnify the Owner/ Executing Agency 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 Executing

Agency/ 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 Executing Agency/ 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 Executing Agency/ Owner of any equipment, machinery, materials, process, methods to be supplied hereunder. The Contractor agrees to and does hereby grant to Executing Agency/ Owner, together with the right to extend the same to any of the subsidiaries of the Executing Agency/ 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 Executing Agency/ 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 Executing Agency/ Owner provided that the Contractor may with the permission of the Engineer-in-Charge/Project Manager, use the same for the purpose of the work by payment of cost of the same at such a rate as may be determined by the Engineer-in-Charge/Project Manager.

37. Liens

37.1 If, at any time there should be evidence or any lien or claim for which the Executing Agency/ Owner might have become liable and which is chargeable to the Contractor, the Executing Agency/ 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 Executing Agency/ Owner against such lien or claim and if such lien or claim be valid, the Executing Agency/ 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 Executing Agency/ Owner all money that the latter may be compelled to pay in discharging such lien or claim including all costs and reasonable expenses. Executing Agency/ Owner reserves the right to do the same.

37.2 The Executing Agency/ 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 to the Engineer-in-Charge/Project Manager a 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 in a form approved by Engineer-in-Charge/Project Manager that all invoices for labour, materials, services have been paid in lien thereof and if required by the Engineer-in-Charge/Project Manager 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 Executing Agency/ Owner harmless, for a period of 02 (Two) years after the issue of Final Certificate, from all liens and other encumbrances against the Executing Agency/ 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 Executing Agency/ Owner will defend at his own expense, any claim or litigation brought against the Executing Agency/ 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 Certificate.

38. Delays by Executing Agency/ Owner or his Authorized Agents

38.1 In case the Contractor's performance is delayed due to any act or omission on the part of the Executing Agency/ Owner or his authorized agents, then the Contractor may be given due extension of time for the completion of the Work after proper due diligence by Executing Agency/ Owner, to the extent such omission on the part of the Executing Agency/ 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 Executing Agency/ 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 Executing Agency/ 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 and accepted by Engineer-in-Charge/Project Manager prior to the date of termination at the rates and prices 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 Executing Agency/ 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/Warrantee 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 Executing Agency/ 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 Executing Agency/ Owner or any of their officials, Employees or Agents nor any order by the Executing Agency/ Owner for payment of money or any payment for or acceptance of the whole or any part of the Work by the Executing Agency/ Owner nor any extension of time, nor any possession taken by Executing Agency/ Owner shall operate as a waiver of any provision of the Contract, or of any power herein reserved to the Executing Agency/ 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 Executing Agency and Liability of Contractor

41.1 No interim payment certificate(s) issued by the Engineer-in-Charge/Project Manager of the Executing Agency/ Owner, nor any sum paid on account by the Executing Agency/ Owner, nor any extension of time for execution of the work granted by Executing Agency/ Owner shall affect or prejudice the rights of the Executing Agency/ 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 Executing Agency/ Owner to pay for alterations, amendments, variations or additional works not ordered, in writing, by Executing Agency/ Owner or discharge the liability of the Contractor for the payment of damages whether due, ascertained, or certified or not or any sum against the payment of which he is bound to indemnify the Executing Agency/ 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.

43. Guarantee Tests & Operations 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.

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 Executing Agency/Owner upon completion of the necessary changes, modifications and/or additions, and shall seek the Executing Agency'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 Executing Agency//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 Executing Agency//Owner shall promptly provide the Contractor with such information as the Contractor may reasonably require in relation to the conduct and results of the Guarantee Test (and any repeats thereof). 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:

- The Plant Performance Guarantee Test (PR Test) in accordance with the procedure specified IN The Tender document Specifications has been successfully completed and the Functional Guarantees are met; or

- The Contractor has paid the liquidated damages, if any, specified in GCC Clause hereof;

43.3.2 At any time after any of the events set out in GCC Sub-Clause have occurred, the Contractor may give a notice to the Project Manager requesting the issue of an Operational Acceptance Certificate in the form provided in the Bidding Documents or in another form acceptable to the Executing Agency//Owner in respect of the Facilities or the part thereof specified in such notice as at the date of such notice.

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

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

43.3.5 Subsequent to Operational Acceptance of the Facilities by the Executing Agency/Owner and within 10 days of the commencement of the O&M period, the Contractor shall furnish an Indemnity Bond which is to be executed by the contractor for the Plant handed over by Executing Agency/Owner for performance of its O&M Contract (Entire Solar Photo Voltaic Plant).

43.4 Final Acceptance

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

- The Plant have achieved the Operational acceptance and served the O&M for the period stipulated under the contract agreement; and
- All the contractors' liabilities under the O&M contract have been satisfied; and
- Contractor has provided the list of recommended spares with detailed specification, source and price for further procurement; and
- The Contractor has paid the liquidated damages, if any thereto;

43.4.2 At any time after the events set out in GCC Sub – Clause have occurred, the Contractor may give a notice to the Project Manager requesting the issue of Final Acceptance Certificate in the form provided in the Bidding Documents or in another form acceptable to the Owner/ Executing Agency in respect of the Facilities or the part thereof specified in such notice as at the date of such notice.

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

43.4.4 If within thirty (30) days after receipt of the Contractor's notice, the Project Manager fails to issue the Final Acceptance Certificate or fails to inform the Contractor in writing of the justifiable reasons why the Project Manager has not issued the Final Acceptance Certificate, 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 minimum period of 5 years as per mutually agreed terms and conditions. The contractor is allowed to submit his intent at the time of Final acceptance.

43.5 The title of Ownership of supplies furnished by the Contractor shall not pass on to the Executing Agency/ Owner for all Supplies till the same are finally accepted by the Executing Agency/ Owner after the successful completion of Performance Test and Guarantee Test and issuance of Final Certificate.

43.6 However, the Executing Agency/ Owner shall have the lien on all such works performed as soon as any advance or progressive payment is made by the Executing Agency/ Owner to the Contractor and the Contractor shall not subject these works for use other than those intended under this Contract.

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 Executing Agency/ Owner.

44.2 The Owner/ Executing Agency and the Contractor shall keep confidential and shall not, without the written consent of the other party hereto, divulge to any third party any documents, data or other information furnished directly or indirectly by the other party hereto in connection with the Contract, whether such information has been furnished prior to, during or following termination of the Contract. Notwithstanding the above, the Contractor may furnish to its Subcontractor(s) such documents, data and other information it receives from the Executing Agency/Owner to the extent required for the Subcontractor(s) to perform its work under the Contract, in which event the Contractor shall obtain from such Subcontractor(s) an undertaking of confidentiality similar to that imposed on the Contractor.

44.3 The Owner/ Executing Agency 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/ Executing Agency 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:

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 Clause, 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 24 hours from the time of occurrence of fault, failing which the Contractor will be liable for additional liquidated damages as per reference to the generation parameters accumulated in similar/ associated equipment of the Plant (for example if a block consists of 4 inverters and one inverter is down for more than 24 hours, then the generation for faulty inverter shall be calculated as the average of accumulated generation for the other 3 inverters over the 24 hours duration of fault as the deemed generation) and the LD shall be levied on the deemed generation as per the tariff of Rs. 7.37 per unit. 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 on the date of Successful demonstration of guaranteed PR i.e., Operational acceptance. However, operation of the Power Plant means operation of system as per bid and workmanship in order to keep the project trouble free covering the guarantee period. The contractor must demonstrate the committed CUF at the end of every year in accordance with commitment made in the Techno-Commercial Enclosures of the Bid.

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.

45.4.2 Contractor shall produce monthly serviceability report for individual components of the plant & associated infrastructure to the Executing Agency//Owner by 5th of next month.

45.4.3 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.

45.4.4 Any complaint related to unserviceability/improper functioning of any & all component of the plant including but not limited to PV Module, PCU, Transformers, switchgears, SCADA, roads, drainage, water supply lighting system, office infrastructure, CCTV system which is not attended & rectified within 48 hours, shall attract a penalty of Rs. 1000 per 24 hours, which shall be over & above GCC Clause. If such complaint is not rectified within 480 hours from logging of complaint. Executing Agency/Owner may choose to rectify the same through any other agency at the risk of Contractor and Executing Agency/Owner shall recover 110% of such cost incurred from subsequent payment to the contractor.

45.4.5 Such rectification work carried out by Executing Agency/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.

45.4.6 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 a minimum manpower structure with following qualification;
Project Manager (B.E./B.Tech Electrical, with minimum 5 years of relevant experience) -1 No.
Shift Engineers (BE/B-Tech Electrical, with minimum 3 years of relevant experience) –1 No / Shift
Polytechnic/Diploma Electrical (with minimum 3 years of relevant experience) -2 / shift
Polytechnic/Diploma Mechanical or Civil (with minimum 3 years of relevant experience) -1/shift
Unskilled for cleaning & other unskilled works with respect to Plant -minimum 3/shift.
However contractor shall engage additional manpower as and when need arise.

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. Commissioning & Spares

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 minor items not materially affecting the operation or safety of the Facilities, the Contractor shall so notify the owner/ Executing Agency (Project Manager/ EIC) in writing to witness the pre- commissioning of the facility.

47.2 As soon as all works in respect of Pre-commissioning are completed and, in the opinion of the Contractor, the Facilities is 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.

47.3 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 or the representatives of the Owner/ Executing Agency.

47.4 If the Project Manager 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.

47.5 If the Project Manager is satisfied that the Facilities have reached Completion, the Project Manager shall, within seven (7) days after receipt of the Contractor's repeat notice, issue a Completion Certificate stating that the Facilities have reached Completion as at the date of the Contractor's repeat notice.

47.6 If the Project Manager is not so satisfied, then it shall notify the Contractor in writing of any defects and/or deficiencies within seven (7) days after receipt of the Contractor's repeat notice, and the above procedure shall be repeated.

47.7 If the Project Manager fails to issue the Completion Certificate and fails to inform the Contractor of any defects and/or deficiencies within fourteen (14) days after receipt of the Contractor's notice under GCC Clause or within seven (7) days after receipt of the Contractor's repeated notice under GCC Clause, or if the Executing Agency/Owner makes use of the Facilities, then the Facilities shall be deemed to have reached Completion as of the date of the Contractor's notice or repeated notice, or as of the Executing Agency's/Owner's use of the Facilities, as the case may be.

47.8 As soon as possible after Completion, the Contractor shall complete all outstanding minor items so that the Facilities are fully in accordance with the requirements of the Contract, failing which the Owner/ Executing Agency will undertake such completion and deduct the costs thereof from any monies owing to the Contractor.

47.9 Upon Completion, commissioning and successful demonstration of the PR test, 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 operation and maintenance as stipulated and mutually agreed terms and conditions.

The Contractor shall furnish to the Executing Agency/ Owner all spares required for Commissioning of the plants, recommendatory and/ or mandatory spares, which are required essential by the manufacturer/ supplier. The same shall be delivered at Site prior to Commissioning. Also, the Contractor should furnish the manufacturing drawings for fast wearing spares.

[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 to the Contractor by the Engineer-in-Charge/Project Manager 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 and to the entire satisfaction of the Engineer-in-Charge/Project Manager. 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 of the best quality and workmanship capable of satisfactory operation under the operating and climatic conditions as may be 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 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. Unforeseen/ Differing site Conditions

49.1 If, during the execution of the Contract, the Contractor shall encounter on the Site any physical conditions (other than climatic conditions) or artificial obstructions that could not have been reasonably foreseen prior to the date of the Contract Agreement by an experienced contractor on the basis of reasonable examination of the data relating to the Facilities, and on the basis of information that it could have obtained from a visual inspection of the Site (if access thereto was available) or other data readily available to it relating to the Facilities, and if the Contractor determines that it will in consequence of such conditions or obstructions incur additional cost and expense or require additional time to perform its obligations under the Contract that would not have been required if such physical conditions or artificial obstructions had not been encountered, the Contractor shall promptly, and before performing additional work or using additional Plant and Equipment or Contractor's Equipment, notify the Project Manager in writing of

- The physical conditions or artificial obstructions on the Site that could not have been reasonably foreseen
- The additional work and/or Plant and Equipment and/ or Contractor's Equipment required, including the steps which the Contractor will or proposes to take to overcome such conditions or obstructions
- The extent of the anticipated delay
- The additional cost and expense that the Contractor is likely to incur and the breakup of the same.

On receiving any notice from the Contractor under this GCC Sub- Clause, the Project Manager shall consult and decide upon the actions to be taken to overcome the physical conditions or artificial

obstructions encountered. Following such consultations, the Project Manager shall instruct the Contractor of the actions to be taken.

49.2 Any reasonable additional cost and expense incurred by the Contractor in following the instructions from the Project Manager to overcome such physical conditions or artificial obstructions referred to in GCC Clause shall be paid by the Executing Agency/Owner to the Contractor as an addition to the Contract Price, after submission of relevant documents justifying same.

49.3 If the Contractor is delayed or impeded in the Performance of the Contract because of any such physical conditions or artificial obstructions referred to in GCC Clause, the Time for Completion shall be extended in accordance with GCC Clause.

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 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. However, these adjustments would be restricted to direct transactions between the Executing Agency//Owner and the Contractor/assignee of Foreign Contractor (if applicable). This adjustment shall not be applicable on procurement of raw materials, intermediary components etc. by the Contractor and shall also not be applicable on bought out items dispatched directly from sub- vendor works to site. Notwithstanding the foregoing, such additional or reduced costs shall not be separately paid or credited if the same has already been accounted for in the price adjustment provisions where applicable.

52. General Conditions for Construction and Erection Work

52.1 The working time at the site of work is 48 hours per week. Overtime work is permitted in cases of need and the Executing Agency/ 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 for quotation. No extra claims will be entertained by the Executing Agency/ 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 Executing Agency/ Owner will not entertain any claim for idle time payment whatsoever.

52.3 The Contractor shall submit to the Executing Agency/ Owner/ Engineer-in-Charge/Project Manager reports at regular intervals regarding the state and progress of Work. The details and proforma of the report will mutually be agreed after the award of Contract. The Contractor shall provide display boards showing progress and labour strengths at worksite, as directed by the Engineer-in-Charge/Project Manager.

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/ item rate quoted by him, the Executing Agency/ 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. The only exception to this will be a case where the Executing Agency/ Owner requests in writing to the Contractor to upgrade the Specifications or the size of any major pieces of equipment, plant or machinery beyond what is normally required to meet the scope of Work as defined in the Contract Document. In such cases, a change order will be initialed by the Contractor at the appropriate time for the Executing Agency's/ Owner's prior approval giving the full back-up data for their review and for final settlement of any impact on price.

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/ Executing Agency.

53.2.2 The Contractor shall be entitled to disclaim responsibility for any design, data, drawing, specification or other document, or any modification thereof provided or designated by or on behalf of the Owner/ Executing Agency, by giving a notice of such disclaimer to the Project Manager/ EIC.

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 as per technical specifications and furnish to the Project Manager for Approval of the same and Review of work schedule.

Any part of the Facilities covered by or related to the documents to be approved by the Project Manager shall be executed only after the Project Manager's approval thereof.

53.3.3 Within ten (10) 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 deemed to have been 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 Executing Agency//Owner 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/ Executing Agency 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.

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/Executing Agency

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 Detailed working drawings on the basis of which actual execution of the Work is to proceed, will be furnished from time to time during the progress of the work. 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 Executing Agency/ Owner shall be returned to the Executing Agency/ 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 directions of Engineer-in-Charge/Project Manager and got 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 to the

satisfaction of Executing Agency/ Owner at no extra cost. All final 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 and shall be modified by the Contractor, if any modifications and/ or corrections are required by the Engineer-in-Charge/Project Manager. The Contractor shall incorporate such modifications and/ or corrections and submit the final 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 As built drawings showing all corrections, adjustments etc. shall be furnished by the Contractor in 06 (Six) Hard Copies and 01 (One) Soft Copy for record purposed to the Executing Agency/ Owner. GFC drawings shall be provided in soft as well as Hard form to Executing Agency/Owner for reference at site. Provision should be made for digitally signing GFC Drawings and making hard copies available at site.

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. The work shall be set out to the satisfaction of the Engineer-in-Charge/Project Manager. The approval there of joining with the Contractor by the Engineer-in-Charge/Project Manager in setting out the work, shall not relieve the Contractor of any of his responsibility.

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 acceptable to the Engineer-in-Charge/Project Manager. 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. No work shall be started until all these points are checked and approved by the Engineer-in-Charge/Project Manager in writing but such approval shall not relieve the Contractor of any of his responsibilities. The Contractor shall also provide all labour, material and other facilities, as necessary, for the proper checking of layout and inspection of the points during construction.

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 deem to be the absolute property of the Executing Agency/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 Executing Agency/Owner of such discovery any carry out, at the expense of the Executing Agency/Owner, the Executing Agency's/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.

58.2 **Transportation**

The contractor shall ensure that all the plant and equipment required to complete the Facility at site, are procured and dispatched on FOR site basis. 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.

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 from manufacturing shop to delivery at Site. Necessary certificates, if so required, shall be issued by the Owner/ Executing Agency within reasonable time after getting written request from the Contractor along with the necessary documents substantiating necessity of such approvals. Contractor shall take necessary insurances to ensure safe transit. All packing material is the property of the Executing Agency/Owner and shall be immediately deposited by the Contractor to the Executing Agency's/Owner's Store at project Site.

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. All the spares, as required for the trouble free O&M of Plant, must be kept under secure storage during O&M period.

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 Executing Agency/ Owner and shall make his own arrangement for procuring such materials and for the transport thereof. The Executing Agency/ Owner may give necessary recommendation to the respective authority if so desired by the Contractor but assumes no further responsibility of any nature. The Executing Agency/ 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.

58.6 No material shall be dispatched from the Contractor's stores before obtaining the approval in writing of the Engineer-in-Charge/Project Manager.

59. Stores Supplied by the Executing Agency/ Owner

59.1 If the Specification of the Work provides for the use of any material of special description to be supplied from the Executing Agency's/ Owner's stores or it is required that the Contractor shall use certain stores to be provided by the Executing Agency/ 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 Executing Agency/ 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 Executing Agency's/ Owner's stores or at a place as directed by the Engineer-in-Charge/Project Manager in perfectly good condition at Contractor's cost.

60. Conditions for Issue of Materials

60.1 **i)** Materials specified as to be issued by the Executing Agency/ Owner will be supplied to the Contractor by the Executing Agency/ Owner form 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 Executing Agency/ Owner as framed from time to time.

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 Executing Agency/ 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 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 Executing Agency/ 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 according to the instructions of the Engineer-in-Charge/Project Manager.

vi) The Executing Agency/ Owner shall not be liable for delay in supply or non-supply of any materials which the Executing Agency/ 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 Executing Agency/ 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 Executing Agency/ 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 Executing Agency/ 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 this constitute a reason for the delay in the execution of the Work.

viii) None of the materials supplied to the Contractor will be utilized by the Contractor for manufacturing item which can be obtained as supplied from standard manufacturer in finished form.

ix) 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 Executing Agency/ Owner.

x) 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 Executing Agency/ 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.

xi) Account of the materials issued by the Executing Agency/ 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.

xii) 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 or to the place as directed by the Engineer-in-Charge/Project Manager.

xiii) Materials/ Equipment(s) supplied by Executing Agency/ Owner shall not be utilized for any purpose(s) than issued for.

61. Material Procured with Assistance of Executing Agency/ 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 Executing Agency/ Owner either by issue from Executing Agency's/ 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 Executing Agency/ Owner and use such materials economically and solely for the purpose of the Contract and not dispose them off without the permission of the Executing Agency/ 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 Executing Agency's/ Owner's property and will be disposed off to the best advantage of the Executing Agency/ 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 Executing Agency/ Owner and the Contractor shall duly preserve the same to the satisfaction of the Engineer-in-Charge/Project Manager and shall from time to time deliver the same to such person or persons indicated by the Executing Agency/ Owner.

64. Discrepancies between Instructions

64.1 Should any discrepancy occur between the various instructions furnished to the Contractor, his agent 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 Executing Agency/ 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 agent duly accredited in writing, present for the purpose. Orders given to the Contractor's agent 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 07 (Seven) day notice in writing to the Engineer-in-Charge/Project Manager before covering up or otherwise placing beyond reach of inspection and measurement of any work in order that the same may be inspected and measured. 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. and the necessary attendance 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 shall be borne by Contractor. Such pre-dispatch inspection(s) at the manufacturer's facility shall be carried out in the presence of the Executing Agency/Owner or their authorized representatives, for such items as is specified by the Engineer-in-Charge/Project Manager. Travel expenses for such inspections shall be borne by the Executing Agency/Owner. 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 borne by the Executing Agency/Owner shall be on account of the Contractor**. 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

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 Executing Agency/ Owner by paying the charges as decided by the Executing Agency/ Owner from time to time. In case of non-availability of testing facility with the Executing Agency/ Owner, the required test shall be carried out at the cost of Contractor at Government or any other testing laboratory as directed by Engineer-in-Charge/Project Manager.

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 as per instructions of Engineer-in-Charge/Project Manager and cost of such tests shall be reimbursed by the Executing Agency/ Owner.

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 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 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 Bad Work

69.1 If it shall appear to the Engineer-in-Charge/Project Manager 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 and in the event of failure to do so within the period specified by the Engineer-in-Charge/Project Manager in his demand aforesaid, the Contractor shall be liable to pay compensation at the rate of 1% (One Percent) of the estimated cost of the whole Work, for every week limited to a maximum of 10% (Ten Percent) of the value of the whole Work, while his failure to do so shall continue and 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.

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. An extension of time for completion, corresponding with the delay caused by any such suspension of the Works as aforesaid will be granted to the Contractor should he apply for the same provided that the suspension was not consequent to any default or failure on the part of the Contractor.

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. Executing Agency/ 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 Executing Agency/ 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 Executing Agency/ Owner may designate or also engage another Contractor to carry out the Work. In such cases, the Executing Agency/ Owner shall deduct from the amount which otherwise might become due to the Contractor, the cost of such work and material with 10% (Ten Percent) added to cover all departmental charges and should the total amount thereof exceed the amount due to the Contractor, the Contractor shall pay the difference to the Executing Agency/ Owner.

72. Possession prior to Completion

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 completion of the Facilities, 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 Executing Agency/Owner ("Defects Liability Period").

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/ Executing Agency 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 Owner/ Executing Agency shall give the Contractor a notice stating the nature of any such defect together with all available evidence thereof, promptly following the discovery thereof. The Owner/ Executing Agency shall afford all reasonable opportunity for the Contractor to inspect any such defect.

73.8 The Owner/ Executing Agency shall provide the Contractor all necessary access to the Facilities and the Site to enable the Contractor to perform its obligations under this Clause (Defect Liability). The Contractor may, with the consent of the Executing Agency/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.

73.9 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 Executing Agency/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.

73.10 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 Executing Agency//Owner and the Contractor for the original equipment/part of the Facilities.

73.11 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 Executing Agency/Owner may, following a notice to the Contractor, proceed to do such work, and the costs incurred by the Executing Agency/Owner in

connection therewith shall be paid to the Executing Agency/Owner by the Contractor or may be deducted by the Executing Agency/Owner from any monies due to the Contractor or claimed under the Performance Guarantee, without prejudice to other rights, which the Owner/ Executing Agency may have against the Contractor in respect of such defects.

73.12 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 Executing Agency/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.

73.13 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.

73.14 The Bidder's liability under this contract for any reason, what so ever, shall be limited to the total Contract Price (Including T & D)

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. 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/ Warrantees 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**

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 Executing Agency/ Owner directly in the name of Executing Agency/ Owner only without any deviation . The Contractor shall give the guarantee/warrantee to the Executing Agency/ Owner directly for other minor Material/Products/Spares.

73.16.1 PV modules must be warranted with linear degradation rate of power output except for first year and shall guarantee 80% of the initial rated power output at the end of 25 years.

73.16.2 The modules shall be warranted for at least 10 years for failures due to material defects and workmanship.

73.16.3 The mechanical structures, electrical works and overall workmanship of the grid connected Solar Power Plant must be warranted for a minimum of 10 years.

73.16.4 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.

73.17 **The warranty / guarantee period shall be as follows**:

73.17.1 Solar PV Modules: Modules shall be warranted for a minimum period of 25 years in the Bidder's detailed Warranty / Guarantee certificate.

73.5.2 Power Conditioning Units (PCU)/ Inverters: PCUs shall be warranted for the minimum period of 5 years or guarantee period provided by the OEM, whichever is higher.

73.5.3 Transformers, associated switch gear and others: Bidder must furnish in detail its warranties / guarantees for these items.

73.18 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, workmanship or any reason attributable to works carried out by the contractor, provided such defective parts are not repairable at Site. After replacement, the defective parts shall be returned to the Contractors works at the expense of the Contractor unless otherwise arranged.

73.19 At the end of guarantee period, the Contractor's liability shall cease. In respect of goods not covered by the GCC Sub Clause, the Executing Agency/Owner shall be entitled to the benefit of such guarantee given to the Contractor by the original Contractor or manufacturer of such goods.

73.20 During the Operation & Maintenance and guarantee 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/ Executing Agency within a reasonable time as may be considered from the date of receipt of such intimation from the Executing Agency/Owner failing which the Executing Agency/Owner reserves the right to take up rectification work at the risk and cost of the Contractor.

73.5.4 Batteries and battery charger shall be warranted for minimum of 2 (two) years against all material/ manufacturing defects and workmanship.

74. Care of Works

74.0 From the commencement to completion of the Work, 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.

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 Executing Agency/ 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 Executing Agency/ Owner will be recovered from the amount due to the Contractor. The decision of the Engineer-in-Charge/Project Manager with regard to the amount to be recovered from the Contractor will be final 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 except for maintenance there provided in clause 73.1 of General Conditions of Contract) and have passed the tests on completion, the Engineer-in-Charge/Project Manager shall issue a Certificate (hereinafter called Completion Certificate) in which he shall certify the date on which the Work have been so completed and have passed the said tests and the Executing Agency/ Owner shall be deemed to have taken over the Work on the date so certified. If the Work has been divided into various groups in the Contract, the Executing Agency/ Owner shall be entitled to take over any group or groups before the other or others and there upon the Engineer-in-Charge/Project Manager shall issue a Completion Certificate which will, however, be for such group or groups so taken over only. In such an event if the group/ section/ part so taken over is related, to the integrated system of the work, not withstanding date of grant of Completion Certificate for group/ section/ part. The period of liability in respect of such group/ section/ part shall extend 12 (Twelve) months from the date of completion of Work.

74.2 Defects after Taking Over

In order that the Contractor could obtain a Completion Certificate 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 or groups of 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 Executing Agency/ 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 Executing Agency/ Owner. If by reason of any default on the part of the Contractor a Completion Certificate has not been issued 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 Executing Agency/ Owner shall be at liberty to use the Work or any portion thereof in respect of which a completion certificate has not been issued, provided that the Work or the portion thereof so used as aforesaid shall be afforded reasonable opportunity for completing these works for the issue of Completion Certificate.

75. Guarantee/ Transfer of Guarantee

75.1 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 Executing Agency/ Owner directly in the name of Executing Agency/ Owner only without any deviation . The Contractor shall give the guarantee/warrantee to the Executing Agency/ Owner directly for other minor Material/Products/Spares.

In case of the contract termination/cancellation and wherein the title of Guarantee/Warrantee 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/Warrantees 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 Executing Agency/ Owner, through the Contractor. In case such a Sub-Contractor is not prepared to furnish a guarantee to the Executing Agency/ Owner, the Contractor shall give that guarantee to the Executing Agency/ Owner directly.

76. Installation and Training of Executing Agency'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/ Executing Agency, 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

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/ Executing Agency.
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 to the satisfaction of the Project Manager.

76.2.2 Contractor's Supervision:

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

76.2.3 Labor:

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, 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 entry of all labor and personnel to be employed by contractor on the Site.

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 labor of its Subcontractors.

The Contractor shall, in all dealings with its labor and the labor 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.

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.

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**

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 contractor, if required, will provide necessary safety training to workmen. The Owner/ Executing Agency shall not be responsible for any such accidents. Also, contractor shall engage sufficient security guards to protect Facility from any theft and unauthorized access to Site.

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.

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, and shall leave the Site and Facilities clean and safe.

76.5.3 **Disposal of Scrap**

The Contractor shall with the agreement of the Owner/ Executing Agency promptly remove from the site any 'Scrap' generated during Performance of any activities at site in pursuance of the Contract. 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 disposal of such Scrap shall vest with the Contractor for the items supplied by the Contractor and issued by Owner/ Executing Agency under this contract for installation and construction without any additional cost to the Executing Agency. The removal of scrap shall be subject to the Contractor

producing the necessary clearance from the relevant authorities (Custom, Excise etc.), 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/ Executing Agency 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 Indemnity Bond shall be furnished by contractor as per Format enclosed. Further, in case the laws require the Executing Agency 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 Executing Agency.

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.

The Contractor undertakes to provide training to Personnel selected and sent by the Executing Agency/ Owner at the works of the Contractor without any cost to the Executing Agency/ Owner. The period and the nature of training for the individual personnel shall be agreed upon mutually between the Contractor and the Executing Agency/ 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. Executing Agency/ Owner shall bear only the to and fro fare of the said personnel.

77. Replacement of Defective Parts and Materials

77.1 If during the progress of the Work, Executing Agency/ 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, Executing Agency/ 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 Executing Agency/ Owner of or affect any rights under the Contract, the Executing Agency/ 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 Executing Agency/ Owner or an officer or agent of the Executing Agency/ Owner, for the failure, omission or neglect on the part of the 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 Executing Agency/ 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 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 Executing Agency/ 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 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. Tenderer 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

The price to be paid by the Executing Agency/ 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/ rates quoted by the Contractor shall remain firm till the issuance of Final Certificate 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 Executing Agency/ 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. Tenderers shall make such provision in the Schedule of Rates as he may consider necessary to cover the cost of such items of Work and materials as may be reasonable and necessary to complete the Work. The opinion of the Engineer-in-Charge/Project Manager as to the items of Work which are necessary and reasonable for Completion of Work shall be final and binding on the Contractor, although the same may not be shown on or described specifically in Contract Documents. 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.

80.3 Schedule of Rates to Cover Construction Equipments, Materials, Labor 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, labor, 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., Value of Contract) 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 Executing Agency/ 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, octroi or 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 Taxes and Duties

No exemption or reduction of Customs 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 Executing Agency/ 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 Lump sum 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 actually 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) 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 Executing Agency/ 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 Form Item Rate Contracts, all measurements shall be recorded in sextuplicate on standard measurement sheets in duly approved formats for scrutiny and passing by Executing Agency/ Owner. Executing Agency/ 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 10 (Ten) days of submission of the bills, complete in all respects and send the same to the Executing Agency/ Owner to effect payment to the Contractor as per the defined payment terms.

81.1.4 Executing Agency/ 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.

81.1.5 Measurements shall be recorded as per the methods of measurement spelt out in Executing Agency/ Consultant Specifications/ Contract Document. Executing Agency/ Owner shall be fully responsible for checking the measurements quantitatively and qualitatively as recorded in the Measurement Books/ Bills.

81.1.6 While preparing the final bills overall measurements will not be taken again. Only volume of work executed since the last measured bill along with summary of final measurements will be considered for the final bill. However, a detailed check shall be made as to missing measurements and in case there are any missing items or measurements the same shall be recorded.

81.2 Void

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 as per the provision of the Contract after certification by Engineer-in-Charge/Project Manager.

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 Executing Agency/ 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 physical completion of the Work; otherwise, the Engineer-in-Charge/Project Manager's certificate of the 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 Executing Agency/ 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. Failure on the part of Contractor to put forward any claim without the necessary particulars as above within the time above specified shall be an absolute waiver thereof. No omission by Executing Agency/ Owner to reject any such claim and no delay in dealing therewith shall be waiver by Executing Agency/ Owner of any of this rights in respect thereof.

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 Executing Agency/ Owner, irrespective of the outcome of such claims, where additional payments for Works considered extra are justifiable in accordance with the Contract provisions, Executing Agency/ Owner shall arrange to release the same in the same manner as for normal Work payments. Such of the extra works so admitted by Executing Agency/ Owner shall be governed by all the terms, conditions, stipulations and specifications as are applicable for the Contract.

85 Payment of Contractor's Bill

85.1 Payment due to the Contractor shall be made by the Executing Agency/ Owner either by e-Payment or e-Banking or by Account Payee Cheque forwarding the same to registered office or the notified office of the Contractor.
In case the payment shall be made through e-payment, E-PAYMENT- Payment of contractor bills through Bank:-Payment due to the contractor may , if so desired by him by made to the Bank instead of direct to him provided that the contractor furnishes to the Engineer – in- charge (1) an authorization in the form of a legally valid account such as power of attorney conforming authority on the Bank to receive payments and (2) his own acceptance of the correctness of the account made out as being due to him by Executing Agency or his signature on the bill or other claim preferred against Executing Agency before settlement by the Engineer – in charge of the account or claim by payment to the Bank. While the receipt given by such banks shall constitute a full and sufficient discharge for the payment the contractor should wherever present his bills duly receipted and discharged through his bankers. Nothing here in contained shall operate to create in favour of the Bank any rights or equities vis – a vis the Board. The date on which e – payment to the contractor by the Executing Agency will be considered as the date of payment for all purposes. Delay in making such payments by the Executing Agency due to to exceptional circumstances shall not nullify or

vitiate in any way or other the conditions of the contract and the contractor shall have no claim on this account. The e-payment format as provided in Section-VII

The Engineers may by any certificate make any correction or modification in any previous certificate which shall be issued by him and shall have power to withhold any certificate if the work or any part thereof is not being carried out to his satisfaction Balance payment will be released on completion of work to the satisfaction of Engineer's Representative. No claim will be entertained by the HRL in this account.

In no case, will Executing Agency/ Owner be responsible if the payment shall be made through 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.
In all other cases, payment will be arranged through RTGS/ NEFT, for this bank charges at the appropriate rates will be payable by the payee.

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.

86 Receipt for Payment

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 Contractor's 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. Completion Certificate

87.1 Application for Completion Certificate

When the Contractor fulfils his obligation under Clause 74.1 he shall be eligible to apply for Completion Certificate. The Engineer-in-Charge/Project Manager shall normally issue to the Contractor the Completion Certificate within 01 (One) Month after receiving any application therefore from the Contractor after verifying from the completion documents and satisfying himself that the Work has been completed in accordance with and as set out in the construction and erection drawings, and the Contract Documents. The Contractor, after obtaining the Completion Certificate, is eligible to present the final bill for the Work executed by him under the terms of Contract.

87.2 Completion Certificate

Within 01 (One) Month of the completion of the Work in all respects, the Contractor shall be furnished with a certificate by the Engineer-in-Charge/Project Manager of such completion, but no certificate shall be given nor shall the Work be deemed to have been executed until all scaffolding, surplus materials and rubbish is cleared off the Site completely nor until the Work shall have been measured by the Engineer-in-Charge/Project Manager whose measurement shall be binding and conclusive. The Works will not be considered as complete and taken over by the Executing Agency/ Owner, until all the temporary works, labor and staff colonies are cleared to the satisfaction of the Engineer-in-Charge/Project Manager. If the Contractor fails to comply with the requirements of this clause on or before the date fixed for the completion of the Work, the Engineer-in-Charge/Project Manager may at the expense of the Contractor remove such scaffolding, surplus materials and rubbish and dispose off the same as he thinks fit and clean off such dirt as aforesaid, and the Contractor shall forthwith pay the amount of all expenses so incurred and shall have no claim in respect of any such scaffolding or surplus materials as aforesaid except for any sum actually realized by the sale thereof.

87.3 Completion Certificate Documents

For the purpose of Clause 87.0 the following documents will be deemed to form the completion documents:

i) The technical documents according to which the Work was carried out.
ii) 06 (Six) sets of construction drawings showing therein the modification and correction made during the course of execution and signed by the Engineer-in-Charge/Project Manager.
iii) Completion Certificate for 'Embedded' and 'Covered up' work.
iv) Certificates of final levels as set out for various works.
v) Certificates of tests performed for various Works.
vi) Material appropriation, Statement for the materials issued by the Executing Agency/ Owner for the Work and list of surplus materials returned to the Executing Agency's/ Owner's store duly supported by necessary documents.

88. Final Decision and Final Certificate

88.1 Upon expiry of the period of liability and subject to the Engineer-in-Charge/Project Manager being satisfied that 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 Engineer-in-Charge/Project Manager shall (without prejudice to the rights of the Executing Agency/ Owner to retain the provisions of relevant Clause hereof) otherwise give a certificate herein referred to as the Final Certificate to that effect and the Contractor shall not be considered to have fulfilled the whole of his obligations under Contract until Final Certificate shall have been given by the Engineer-in-Charge/Project Manager notwithstanding any previous entry upon the Work and taking possession, working or using of the same or any part thereof by the Executing Agency/ Owner.

89. Certificate and Payments on Evidence of Completion

89.1 Except the Final Certificate, no other certificates or payments against a certificate or on general account shall be taken to be an admission by the Executing Agency/ 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 Executing Agency/ 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 Executing Agency/ Owner. All such claims shall be billed by the Executing Agency/ 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 Executing Agency/ Owner may, then, deduct the amount from any moneys due i.e., 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 Executing Agency/ Owner of such claims.

[G] TAXES AND INSURANCE

91. Goods & Service Tax (GST)/Taxes

91.1 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 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 Executing Agency/ 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 Executing Agency/ 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.

92. GST

92.1 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. Executing Agency/ Owner shall not be responsible for any such liability of the Contractor in respect of this Contract.

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 taxes shall be indicated in Agreed SOR formats.

93.2 In case of any variation (positive/ negative) in existing rates of GST/taxes 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.

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 Executing Agency/ Owner.

94. Insurance

94.1 During the entire 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 Executing Agency/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 Contract 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 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/Executing Agency should take the extension of insurance. Any financial implications shall, however, 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. The Owner/ Executing Agency will not be responsible for any such loss or mishap.

94.6 All other insurance like In – transit insurance (Marine/ Cargo/ others as applicable), Contractor All Risk, Erection All Risk, workmen compensation , third party liability, insurance against theft and acts of GOD and others as required for the Construction and O&M of the Plant and to indemnify the Executing Agency/ equipment/ material and resources shall be borne by the Contractor. Fire insurance is to be arranged by the Contractor up to the years of O&M of the Contract.

94.7 Owner/ Executing Agency shall be named as co – insured under all insurance policies taken out by the contractor pursuant to GCC Clause, except for the workmen compensation, third party liability and Owner's/Executing Agency's liability insurances. Also, Contractors' sub – contractor shall be named as co – insured under all insurances taken out by the contractor pursuant to GCC Clause except for Cargo insurance, workmen compensation insurance and Executing Agency's/Owner's liability insurance. 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.

94.9 The insurance are 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 Executing Agency/Owner from all associated risks whatsoever.

94.10 Employees State Insurance (ESI) Act

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 Executing Agency/ 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 Executing Agency/ 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. The Executing Agency/ Owner shall retain such sum as may be necessary from the total Value of Contract until the Contractor shall furnish satisfactory proof that all contributions as required by the Employees State Insurance Act, 1948, have been paid. This will be pending on the Contractor when the ESI Act is extended to the place of work.

94.11 Workmen Compensation and Executing Agency'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 Executing Agency's/ Owner's liability insurance for the later employees if such Employees are not covered under the Contractor's Insurance.

94.12 Accident or Injury to Workmen

The Executing Agency/ 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 save and except an accident or injury resulting from any act or default of the Executing Agency/ Owner, his agents or servants and the Contractor shall indemnify and keep indemnified the Executing Agency/ 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 Insurance

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

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 Executing Agency'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 Executing Agencyship of such vehicles.

94.15 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.

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 2 (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 to 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 Executing Agency/ 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.

viii) **ANY OTHER INSURANCE REQUIRED UNDER LAW OR REGULATIONS OR BY EXECUTING AGENCY/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 Executing Agency/ Owner. He shall also carry and maintain any other insurance which may be required by the Executing Agency/ Owner.

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

95.1 Contractor shall be responsible for making good to the satisfaction of the Executing Agency/ Owner any loss or any damage to structures and properties belonging to the Executing Agency/ Owner or being executed or procured or being procured by the Executing Agency/ Owner or of other agencies within in the premises of all the work of the Executing Agency/ 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.

95.2 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 Executing Agency/ Owner or any third party including overhead and underground cables and in the event of any damage resulting to the property of the Executing Agency/ 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 Executing Agency/ 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.

95.3 The Contractor shall indemnify and keep the Executing Agency/ Owner harmless of all claims for damages to property other than Executing Agency'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] LABOR LAWS

96. Labor Laws & Indemnity Bond

i) No labor below the age of 18 (Eighteen) Years shall be employed on the Work.

ii) The Contractor shall not pay less than what is provided under law to laborers engaged by him on the Work.

iii) The Contractor shall at his expense comply with all labor laws and keep the Executing Agency/ Owner indemnified in respect thereof.

iv) The Contractor shall pay equal wages for men and women in accordance with applicable labor laws.

v) If the Contractor is covered under the Contract Labor (Regulation and Abolition) Act, he shall obtain a license from licensing authority (i.e. office of the labor commissioner)/shramsuvidha portal at http://shramsuvidha.gov.in by payment of necessary prescribed fee and the deposit, if any, before starting the Work under the Contract. Such fee/ deposit shall be borne by the Contractor.

vi) The Contractor shall employ labor 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 and to the satisfaction of the Engineer-in-Charge/Project Manager.

vii) The Contractor shall furnish to the Engineer-in- Charge the distribution return of the number and description, by trades of the work people employed on the works. The Contractor shall also submit on the 4th and 19th of every month to the Engineer-in-Charge/Project Manager a true statement showing in respect of the second half of the preceding month and the first half of the current month (1) the accidents that occurred during the said fortnight showing the circumstances under which they happened and the extent of damage and injury caused by them and (2) the number of female workers who have been allowed Maternity Benefit as provided in the Maternity Benefit Act 1961 on Rules made thereunder and the amount paid to them.

viii) The Contractor shall comply with the provisions of the Payment of Wage Act 1936, Employee Provident Fund Act 1952, Minimum Wages Act 1948. Executing Agencys Liability Act 1938. Workmen's Compensation Act 1923, Industrial Disputes Act 1947, the Maternity Benefit Act 1961 and Contract Labor Regulation and Abolition Act 1970, Employment of Children Act 1938 or any modifications thereof or any other law relating thereto and rules made thereunder from time to time.

ix) The Engineer-in-Charge/Project Manager shall on a report having been made by an Inspecting Officer as defined in Contract Labor (Regulation and Abolition) Act 1970 have the power to deduct from the money due to the Contractor any sum required or estimated to be required for making good the loss suffered by a worker or workers by reason of non- fulfillment of the Conditions of the Contract for the benefit of workers, non-payment of wages or of deductions made from his or their wages which are not justified by the terms of the Contract or non-observance of the said regulations.

x) The Contractor shall indemnify the Executing Agency/ Owner against any payments to be made under and for the observance of the provisions of the aforesaid Acts without prejudice to his right to obtain indemnity from his Sub-Contractor's. In the event of the Contractor committing a default or breach of any of the provisions of the aforesaid Acts as amended from time to time, of furnishing any information or submitting or filling and Form/ Register/ Slip under the provisions of these Acts which is materially incorrect then on the report of the inspecting Officers, the Contractor shall without prejudice to any other liability pay to the Executing Agency/ Owner a sum not exceeding INR 5000 as Liquidated Damages for every default, breach or furnishing, making, submitting, filling materially incorrect statement as may be fixed by the Engineer-in-Charge/Project Manager and in the event of the Contractor's default continuing in this respect, the Liquidated Damages may be enhanced to INR 5000 per day for each day of default subject to a maximum of 01 (One) Percent of the estimated cost of the Work put to tender. The Engineer-in-Charge/Project Manager shall deduct such amount from bills or Contract Performance Security of the Contractor and credit the same to the Welfare Fund constitute under these acts. The decision of the Engineer-in-Charge/Project Manager in this respect shall be final and binding.

xi) The Contractor shall also indemnify to keep the Owner/ Executing Agency harmless from any act of omission or negligence on the part of the Labor Laws compliance in following the statutory requirements with regard to Labor 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 labor law compliance . Further, in case the laws require the Executing Agency/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 Executing Agency/Owner.

97. Implementation of Apprentices Act, 1961

97.1 The Contractor shall comply with the provisions of the Apprentices Act, 1961 and the Rules and Orders issued thereunder from time to time. If he fails to do so, his failure will be a breach of the Contract and the Engineer-in-Charge/Project Manager may, at his discretion, cancel the Contract. The Contractor shall also be liable for any pecuniary liability arising on account of any violation by him of the provisions, of the Act.

98. Contractor to Indemnify the Executing Agency/ Owner

98.1 The Contractor shall indemnify the Executing Agency/ Owner and every member, office and employee of the Executing Agency/ 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 Executing Agency/ 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 Executing Agency/ 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 Executing Agency/ 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 Executing Agency/ 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 Executing Agency/ 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 Executing Agency/ 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 Executing Agency/ 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 Executing Agency/ Owner is obliged to pay compensation to a workman employed by the Contractor in execution of the Work, the Executing Agency/ Owner will recover from the Contractor the amount of the compensation so paid, and without prejudice to the rights of Executing Agency/ Owner under Section 12, Sub- section (2) of the said Act, Executing Agency/ 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 Executing Agency/ 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 Executing Agency/ Owner full security for all costs for which the Executing Agency/ Owner might become liable in consequence of contesting such claim.

99. Health and Sanitary Arrangements for Workers

99.1 In respect of all labor 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 Executing Agency/ Owner from time to time for the protection of health and sanitary arrangements for all workers.

99.2 The Contractor shall provide in the labor 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 labor colony.

[I] APPLICABLE LAWS & SETTLEMENT OF DISPUTES

100 A. Adjudicator

100 A.1 If any dispute of any kind whatsoever shall arise between the Owner/Executing Agency and the Contractor in connection with or arising out of the Contract, including without prejudice to the generality of the foregoing, any question regarding its existence, validity or termination, or the execution of the facilities-whether during the progress of the facilities or after their completion and whether before or after the termination, abandonment or breach of the contract-parties shall seek to resolve such a dispute or difference by mutual consultation. If the parties fail to resolve such a dispute or difference by mutual consultation, then the dispute shall be referred in writing by either party to the Adjudicator, with a copy to the other party.

100 A.2 The dispute adjudication board (DAB) shall consists of either one or three suitably qualified member ("the Members").

100 A.3 If the DAB consists of three members, each party shall nominate one member for the approval of the other party. The parties shall consult both the members and shall agree upon third member, who shall be appointed as Chairman of DAB.

100 A.4 The Adjudicator shall give its decision in writing to both parties within twenty-eight (28) days of a dispute being referred to it. If the Adjudicator has done so, and no notice of intention to commence arbitration has been given by either the Owner/Executing Agency or the Contractor within fifty – six (56) days of such reference, the decision shall become final and binding upon the Owner/Executing Agency and the Contractor. Any decision that has become final and binding shall be implemented by the parties forthwith.

100 A.5 Should the Adjudicator resign or prolonged absence from work assigned due to unforeseen circumstances, or should the Owner/Executing Agency and the Contractor agree that the Adjudicator is not fulfilling its functions in accordance with the provisions of the contract, a new Adjudicator shall be jointly appointed by the Owner/Executing Agency and the Contractor. Failing agreement between the two within twenty eight (28) days, the new Adjudicator shall be appointed at the request of either party or by the Appointing Authority The adjudicator shall be paid fee plus reasonable expenditures incurred in the execution of its duties as adjudicator under the contract. This cost shall be divided equally between the Owner/Executing Agency and the Contractor.

100 B. Arbitration

100 B.1 Unless otherwise specified, the matters where decision of the Engineer-in-Charge/Project Manager 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 referred to arbitration by Sole Arbitrator. The Executing Agency/ Owner shall suggest a panel of three independent and distinguished persons to the Bidder/ 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 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 the Executing Agency/ Owner shall have discretion to proceed with the appointment of the Sole Arbitrator. The decision of Executing Agency/ 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 New Delhi, India. 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 New Delhi. Bidders/ Suppliers/ Contractors may please note that the Arbitration & Conciliation Act 1996 was enacted by the Indian Parliament and is based on United Nations Commission on International Trade Law (Uncitral Model Law), which were prepared after extensive consultation with Arbitral Institutions and centers of International Commercial Arbitration. The United Nations General Assembly vide resolution 31/98 adopted the Uncitral Arbitration Rules on 15th December 1976.

100 B.2 **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 "**Himachal Pradesh**" for the purposes of disputes, actions and proceedings arising out of the Contract, the courts at "**Himachal Pradesh"** only will have the jurisdiction to hear and decide such disputed, actions and proceedings.

[J] SAFETY CODES

102. General

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. Bidder(s) have to comply with Tamil Nadu State Pollution Board regulation.

103. Safety Regulations

103.1 **i)** In respect of all labor, 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 Executing Agency/ Owner. Before starting construction work Contractor shall consult with Executing Agency's/ Owner's safety Engineers or Engineer-in-Charge/Project Manager and must make good to the satisfaction

of the Executing Agency/ 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 Executing Agency'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 outside arrangements for Ambulance Service and for the treatment of industrial injuries. Names of those providing these services shall be furnished to Executing Agency/ 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 Executing Agency/ Owner, and a copy of Contractor's report covering each personal injury requiring the attention of a physician shall be furnished to the Executing Agency/ Owner.

105. General Rules

105.1 Smoking within the battery area, tank farm or dock limits is strictly prohibited. Violators of the no smoking rules shall be discharged immediately.

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 Executing Agency's/ Owner's inspectors.
d) Executing Agency'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 Executing Agency'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.

107. Scaffolding

107.1 **i)** Suitable scaffolding should be provided for workmen for all works that cannot safely be done from the ground or from solid construction except such short period work as can be done safely from ladders. When a ladder is used an extra Mazdoor shall be engaged for holding the ladder and if the ladder is used for carrying material as well, suitable footholds and handholds shall be provided on the ladder and the ladder shall be given an inclination not steeper than 1 in 4 (1 Horizontal and 4 Vertical).

ii) 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.

iii) 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.

iv) 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.

v) Safe-means of access shall be provided to all working platforms and other working places, every ladder shall be securely fixed. No portable single ladder shall be over 9 meters in length while the width between side rails in rung ladder shall in no case be less than 30cms for ladder up to and including 3 meters in length. For longer ladder this width should be increased 5mm for each additional foot of length. Uniform steps spacing shall not exceed 30cms. Adequate precautions shall be taken to prevent danger from electrical equipment. No materials on any of the sites or work shall be so stacked or placed to cause danger or inconvenience to any person or public. The Contractor shall also provide all necessary fencing and lights to protect the workers and staff from accidents, and shall be bound to bear the expenses of defense of every suit, action or other proceeding of law that may be brought by any person for injury sustained owing to neglect of the above precautions and pay any damages and costs which may be awarded in any such suit or action or proceeding to any such person or which may with the consent of the Contractor be paid to compromise any claim by any such person.

108. Excavation and Trenching

108.1 All trenches 1.2 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 by the Engineer-in-Charge/Project Manager, 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 patent 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) In case of departmental machine, the safe working load shall be notified by the Engineer-in-Charge/Project Manager. 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 Welfare Officer, Engineer-in-Charge/Project Manager or safety Engineer of the Administration or their representatives.

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 Executing Agency/ Owner.

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 Fire Extinguishers, Fire Buckets and drums at worksite as recommended by Engineer-in-Charge/Project Manager. 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 Executing Agency/Owner against any loss or damage resulting directly or indirectly therefrom.

114 Mines Act

114.1 SAFETY CODE: The Contractor shall at his own expense arrange for the safety provisions as required by the Engineer-in-Charge/Project Manager in respect of all labour directly employed for performance of the Works and shall provide all facilities in connection therewith. In case the Contractor fails to make arrangements and provides necessary facilities as aforesaid, the Engineer-in-Charge/Project Manager shall be entitled to do so and recover the costs thereof from the Contractor.

114.2 Failure to comply with Safety Code or the provisions relating to report on accidents and to grant of maternity benefits to female workers shall make the Contractor liable to pay Company Liquidated Damages an amount not exceeding INR 50/- for each default or materially incorrect statement. The decision of the Engineer-in-Charge/Project Manager in such matters based on reports from the Inspecting Officer or from representatives of Engineer-in-Charge/Project Manager shall be final and binding and deductions for recovery of such Liquidated Damages may be made from any amount payable to the Contractor from all the provisions of the Mines Act, 1952 or any statutory modifications or re-enactment thereof the time being in force and any Rules and Regulations made thereunder in respect of all the persons employed by him under this Contract and shall indemnify the Executing Agency/ Owner from and against any claim under the Mines Act or the rules and regulations framed thereunder by or on behalf of any persons employed by him or otherwise.

115. Preservation of Place

115.1 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 Executing Agency/ 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 Executing Agency/ Owner shall be recoverable from the Contractor.

116. Outbreak of Infectious Diseases

116.1 The Contractor shall remove from his camp such labor and their facilities who refuse protective inoculation and vaccination when called upon to do so by the Engineer-in-Charge/Project Manager's representative. 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 required by the Engineer-in-Charge/Project Manager failing which within the time specified in the Engineer's requisition, the work may be done by the Executing Agency/ Owner and the cost thereof recovered from the Contractor.

117. Use of Intoxicants

117.1 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 and Indian Standard Code framed from time to time.

SECTION - V

SPECIAL CONDITIONS OF CONTRACT (SCC)

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 (Clause No. 1)	**The Executing Agency is:** **Solar Energy Corporation of India Limited,** D - 3, 1st Floor, Wing - A, Prius Platinum Building, District Centre Saket, New Delhi - 110 017 Kind Attn.: General Manager (C & P) / Manager (C & P) Telephone Nos.: - 0091-(0)11-71989256/ 71989290 Fax No.: - 0091-(0)11-71989243 E-mail: - **contracts@seci.co.in** **The Owner is:** Himachal renewable limited c/o Himachal Pradesh State Electricity Board Ltd Vidyut Bhawan Shimla Shimla, Himachal Pradesh – 171004 Kind Attn.: BRIJ MOHAN Sud Director (Technical) Telephone Nos.: 9418028701 E mail: brij1359@gmail.com
2.		**The Engineer-in-Charge is**: "**To be nominated"**
3.		**Time for Completion is:** **18 (Eighteen) Months** from the date of issuance of NOA/ LOI/ LOA as detailed below in Table No. 3.1. Further Contractor is also to provide Operation & Maintenance Contract of Solar Photo Voltaic Plant for a period of 5 (five) years from the date of Operational Acceptance of the Plant.

Table No. 3.1

S. No.	Stage	Reference from D
3.1.1	Issue of NOA/ LOI/ LOA	Zero Date (D)

3.1.2	Detailed Engineering Design and Drawing Approvals & Procurement Planning and Approval	D + 2 Months
3.1.3	Completion of supply of major equipment like SPV Modules (including structure for the above), Power Conditioning Units, transformers etc.	D + 4 Months
3.1.4	Installation of all Major Equipment	D + 12 Months
3.1.5	Interconnection of all Major Equipments and Completion of Installation	D + 17 Months
3.1.6	Completion, Testing and Pre-Commissioning of Solar PV Power Plant	
3.1.7	Commissioning of Plant along with Completion of Facilities in line with Technical/ Functional/ Performance Requirement stated under this Tender Document along with demonstration of PG Tests as mentioned in the SCC	**D + 18 Months**

SCC No.	GCC Clause Ref. No. (If Applicable)	Details/ Description/ Special Conditions
4.	Location of Site (Clause No. 2.1.a)	The Location of Site is: The Grid Connected Solar PV Power Plant shall be installed at KAZA, Himachal Pradesh. The contractor has to suitably plan the layout of the Plant including shadow analysis for optimum utilization of Space and the structural analysis. For actual distance/ routing of cables & evacuation, Bidders are advised to visit the site. The allocated land will be handed over to the Contractor by the owner. The project sites are within the Mountain Climatic Zon**e**, hence the contractor shall strictly follow proper care, work permit & safety system. (Refer Section-VII for the Project site layout)
5.	New Clause (Notice of Operation)	The Contractor shall not carry out important operation without the consent in writing of the Executing Agency/Owner or his representative. For carrying out such important activity, the Contractor shall intimate to the Executing Agency/Owner at least 72 hours before starting of the job.
		Against EPC/ LSTK Contract & O&M Contract of the project, within 30 (Thirty) days from the issuance of the Notification of Award/ Letter of Intent/ Letter of Allocation from Executing Agency/ Owner, the successful bidder shall furnish an unconditional and irrevocable Contract Performance Security as below. The Contract Performance Security shall be in the form of either Banker's Cheque or Demand Draft or Bank Guarantee and shall be in the currency of the Contract and will be issued in the name of the Owner as **"Himachal renewable Limited"**

SCC No.	GCC Clause Ref. No. (If Applicable)	Details/ Description/ Special Conditions
6.	New Clause (Contract Performance Security)	The Contract Performance Security against this Contract need to be furnished in 02 (Two) different stages as mentioned below: - 1. First Stage (Supply and Services): The value of the Contract Performance Security shall be 10% of the Contract Value (i.e., total sum of the Supply Contract & Service Contract) and will remain valid 90 (Ninety) days beyond half of the prescribed O & M Period, i.e. 2.5 (Two and Half) Years. Henceforth, 10% Contract Performance Security needs to be furnished for the first 2.5 (Two and Half) Years of the O & M period. 2. Second Stage (O&M): The Performance security shall be furnished 30 days prior to completion of first 2.5 years of O&M and value of the Contract Performance Security shall be 5% of the Contract Value (i.e., total sum of the Supply Contract & Service Contract) and will remain valid 90 (Ninety) days beyond the balance O & M Period, i.e. 2.5 (Two and Half). Henceforth, 5% Contract Performance Security needs to be furnished for the last 5 (five) of the O & M period. 3. Contractor needs to furnish the revised Contract Performance Security amounting 5% of the total Contract Value as mentioned above within the validity period of the Contract Performance Security submitted at First Stage. 4. In case the Contractor fails to furnish the Contract Performance Security mentioned under the Second Stage within the indicated time period as mentioned above under point no. 3, Executing Agency/ Owner at their sole discretion will forfeit the Contract Performance Security furnished at First Stage. 5. The Contract Performance Security shall be towards faithful performance of the contractual obligations and performance of equipment. 6. 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. 7. 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. Executing Agency/ Owner at its sole discretion may cancel the Contract Agreement/ NOA/ LOI/ LOA & forfeit 100% of EMD, in case Contract Performance Security is not submitted within 40 (Forty) days from issuance of NOA/ LOI/ LOA. However, total project completion period shall remain same. Part Security shall not be accepted.

SCC No.	GCC Clause Ref. No. (If Applicable)	Details/ Description/ Special Conditions
		8. Rest of the standard Performance Security clauses will prevail as per ITB clause 38 **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 (5 Years) subject to the approval and acceptance of the O&M period deliverables by the Engineer in charge/Technical Team.**
7.	New Clause (Performance Measurement Procedure)	The Plant performance will be evaluated as defined under Section VII, Scope of Work and Technical Specifications, "**PERFORMANCE GUARANTEE TEST PROCEDURE"**
8.	New Clause (Compensation for PR and CUF deviations)	1. During the Operational Acceptance any shortfall in the Performance Ratio (PR) as determined through the PR Test Procedure specified Section VII, Scope of Work and Technical Specifications, Annexure – B "**PERFORMANCE GUARANTEE TEST PROCEDURE",** will attract imposition of penalty. For every 0.01 shortfall in PR below 0.78 by the bidder, a penalty of 0.1% of the total Contract Value (i.e., total sum of all the Supply Contract, Service Contract and absolute value of O & M Contract) shall be levied. In case the Plant PR result is 0.05 below 0.78, i.e., 0.73 or lower, the total Contract Performance Security submitted by the bidder will be forfeited. In case the Contract Performance Security has already been encashed on account of delays, the due amount will be recovered from the Final Instalment of the EPC payable at the end of the first year (as per the Terms of Payment specified in SCC) 2. Difference in units derived from committed and achieved CUF x Rs. 7.37; for period after commissioning till the O&M contract closure. The CUF shall be evaluated as per the formula mentioned Section VII, Scope of Work and Technical Specifications. 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 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. 4. Penalty during O&M period against breakdown of other Infrastructure of Solar Power 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

SCC No.	GCC Clause Ref. No. (If Applicable)	Details/ Description/ Special Conditions
		for the Project (Section-VII: Scope of Works & Technical Specifications) shall be penalised @ Rs.1000/day, per incident of breakdown reported beyond 48 Hours of such reporting. Cumulative value of such penalty shall be limited to 50% of yearly O&M cost. 5. 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.
9.	New Clause (Award of Contract)	Owner shall issue separate Orders (NOA/ LOI/ LOA) for different components of the contract i.e., (i) **First Contract (Supply and Services):** FOR destination basis Supply including Transportation for delivery at site and Insurance of all Equipment and materials including mandatory spares and any other supplies specified in the Contract Documents & providing all services i.e., including Unloading, Storage, Handling at Site, Civil Works, Erection, Installation, Testing and Commissioning including Performance Testing in respect of all the Equipment supplied under the scope of Supply and any other services specified in the Contract Documents.. (ii)**Second Contract (O&M)**: For providing Comprehensive operation & maintenance of the Solar PV plant for 5 (five) years 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. Both contracts will contain a cross fall breach clause specifying that breach of one will constitute breach of the other
10.	New Clause (Payment Terms)	**A.** The payment for the First Contract (related to Supply Portion) shall be made as per the following terms and conditions: i) Interest bearing adjustable initial advance (OPTIONAL) of 10% of the Contract Value (i.e., total sum of all the Supply Contract & Service Contract) shall be released to successful bidder upon receipt of unconditional acceptance of NOA/ LOI/ LOA, 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 addition to the Contract Performance Security. The annual interest rate shall be calculated based on SBI one year MCLR as applicable.

SCC No.	GCC Clause Ref. No. (If Applicable)	Details/ Description/ Special Conditions
		ii) Seventy percent (70%) 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 Executing Agency's authorized representative in original. (a) If Successful Bidder has opted for advance then, Ten percent (10%) (full amount of advance) shall be adjusted while making payments of this installment. Also, up-to-date accrued interest shall also be recovered. (iii) Twenty percent (20%) payments shall be paid against successful erection, testing and commissioning of materials at site and Operational Acceptance of the Facility pursuant to successful Guarantee Tests and demonstration of Performance Ratio (PR) including submission of all as-built drawings and documents. (iv) Final Ten percent (10%) payment of Supplies shall be paid after CUF demonstration on completion of first year of O&M of the Facility pursuant to submission of all requisite documentation. However, this Payment may also be released after demonstration of PR and submission of all requisite documentation on the submission of Bank Guarantee of equivalent amount. The BG shall be valid up to demonstration of CUF for the successful first year of Operation. However, in case of delay, the BG shall be extended suitably. **B.** Now, For the First Contract (related to Services Part), the payment shall be made as detailed below. No Initial Advance Payment shall be made against Second Contract related to Service Part. **Further, such kind of adjustments may be made by Owner/Executing Agency from either First Portion or the Second Portion of the Service Contract.** i) For the First Portion of the Services Part of First Contract (i.e. Erection, Testing and Commissioning Portion), the payment shall be made as detailed below: - (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.

SCC No.	GCC Clause Ref. No. (If Applicable)	Details/ Description/ Special Conditions
		(b) Ten Percent (10%) of the total price of Design, Engineering, Erection, Testing and Commissioning shall be paid on Operational Acceptance of the Facility pursuant to successful integration with existing internal grid system, Guarantee Tests and demonstration of PR. (c) Final Ten percent (10%) payments shall be paid after CUF demonstration after first year of O&M of the Facility pursuant to submission of all requisite documentation. However, this Payment may also be released after successful Guarantee Tests and demonstration of PR and submission of all requisite documentation on the submission of Bank Guarantee of equivalent amount. The BG shall be valid up to demonstration of CUF for the successful first year of Operation. However, in case of delay, the BG shall be extended suitably. ii) For the Second Portion of the Services Part of First Contract (i.e. Civil & Allied Works), the payment shall be made as detailed below: (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. (b) Ten Percent (10%) of the total price of Civil Works shall be paid on completion of all the civil works including finishing and debris removal. (c) Final Ten (10%) of the total price of Civil Works shall be paid after CUF demonstration after first year of O&M of the Facility pursuant to completion of all the civil works including finishing and debris removal. However, this Payment may also be released after completion of all the civil works including finishing and debris removal on submission of Bank Guarantee of equivalent amount. The BG shall be valid up to demonstration of CUF for the successful first year of Operation. However, in case of delay, the BG shall be extended suitably. **C.** For the Second Contract (related to Operation & Maintenance Part), the payment shall be made as detailed below: - (a) Against successful Operation and Maintenance of the Facility on quarterly basis at the end of every quarter for each year till 5 (five) years. The O&M of the plant will commence from the date of Operational Acceptance/Commercial Operations Date of the facility. (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

SCC No.	GCC Clause Ref. No. (If Applicable)	Details/ Description/ Special Conditions
		D. All the payment shall be released from Owner's Head Office, **Himachal renewable limited**, upon submission of Original Documents as mentioned against each Payment Milestones, Joint Commissioning and Handing Over Certificate duly certified by the authorized representative of Executing Agency.
11.	New Clause (Starting of Works)	The date of issue of Notification of Award (NOA) shall be treated as the Zero day for the start of work & there by Contract Timeline. The Contractor shall be required to start the work within 15 (fifteen) days from the date of issue of Notification of Award (NOA) and shall thereof, report to the Project Manager/ Engineer-in-charge accordingly. During these 15 days following things are to be accomplished; (a) PM/ EIC at its own discretion may call a kick-off meeting, where broader guidelines of EPC shall be discussed. (b) Contractor's representative from Procurement, design, Project Execution team shall participate in this meeting & submit their Plan with respect to EPC works. (c) Contractor shall submit the baseline schedule of Project activities within 15 days from the date of NOA (d) Communication Protocol for Project coordination to be frozen by the PM/EIC, within this timeline Contractor must identify & communicate the details of their nodal persons for Procurement, Design & Execution.
12.	New Clause (Handing Over – Taking Over)	The work shall be taken over by the Owner upon successful completion of all tasks to be performed at Site(s) on equipment supplied, installed, erected and commissioned by the Contractor in accordance with provision of Tender Document. During handing over complete project work, the Contractor shall submit the following for considering final payment: (a) All as- Built Drawings and documents as per the contract coordination procedure set out for the successful completion of the project. (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. (c) Bill of material. (d) Inventory of recommended and mandatory spares at project Site. (e) Immediately after taking over of complete facilities (s), the same will be handed over to the Contractor for Operation & Maintenance for a period of as mentioned in the bidding document.

SECTION - VI

SAMPLE FORMS

&

FORMATS

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, in the form included hereafter acceptable to the Executing Agency, 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 Executing Agency 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 Executing Agency 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 Executing Agency. The Executing Agency's decision in this regard shall be final and binding.

LIST OF FORMS & FORMAT	
Form No.	**Description**
F-0	COVERING LETTER
F-1	BIDDER'S GENERAL INFORMATION
F-4	PROFORMA OF "BANK GUARANTEE" FOR "EARNEST MONEY DEPOSIT (EMD)"
F-6	NO DEVIATION CONFIRMATION
F-7	DECLARATION REGARDING BANNING AND LIQUIDATION, COURT RECEIVERSHIP ETC.
F-9	PROFORMA OF "BANK GUARANTEE" FOR "CONTRACT PERFORMANCE SECURITY"
F-13	BIDDER'S EXPERIENCE
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
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	Standard format for E-payment

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)
D - 3, 1st Floor, Wing - A, Prius Platinum Building
District Centre, Saket, New Delhi - 110 017

Sub: Bid for "Tender for Design, Engineering, Supply, Construction, Erection, Testing, Commissioning including 5 Years Plant O&M of 2 MW (AC) Solar PV Power Plant with 01 MW BESS at KAZA, Himachal Pradesh"

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 including 5 Years Plant O&M of 2 MW (AC) Solar PV Power Plant with 01 MW BESS at KAZA, Himachal Pradesh" hereby submit our Bid comprising of Techno Commercial Bid and Price Bid. We confirm that neither we nor any of our Parent Company/ Affiliat / Ultimate Parent Company has submitted Bid other than this Bid directly or indirectly in response to the aforesaid tender.

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 2 MW (AC) Solar Power Plant with 01 MW BESS.

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 affect 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

    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 etc through Offline and Online, Techno-Commercial documents through online as per clause no. 11.I 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 {180 (One Hundred and Eighty Days)} from the date of opening of "Techno-Commercial/ Un-priced Bid (Envelope-I)**". 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.

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 Certifiation 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 bidder/company is having any conflict of interest from participating in the proposed empanelment	Yes or No :
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	Whether Bidder is under any liquidation court receivership or similar proceedings	Yes/No
25	Bidding company is listed in India	Yes/No
26	Whether company is MSME as on the bidding date	Yes/No

(Signature of Authorized Signatory)

With Stamp

Form F-4

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.

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

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)
D - 3, 1st Floor, Wing - A, Prius Platinum Building
District Centre, Saket, New Delhi - 110 017

Sub: Bid for ""Tender for Design, Engineering, Supply, Construction, Erection, Testing, Commissioning including 5 Years Plant O&M of 2 MW (AC) Solar PV Power Plant with 01 MW BESS at KAZA, Himachal Pradesh".

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:

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)
D - 3, 1st Floor, Wing - A, Prius Platinum Building
District Centre, Saket, New Delhi - 110 017

Sub: Bid for ""Tender for Design, Engineering, Supply, Construction, Erection, Testing, Commissioning including 5 Years Plant O&M of 2 MW (AC) Solar PV Power Plant with 01 MW BESS at KAZA, Himachal Pradesh".

Dear Sir / Madam,

We hereby confirm that we are not on Banning List by Executing Agency/ 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 Executing Agency/ 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 Executing Agency/ 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 Executing Agency/ Owner by us.

Place: [Signature of Authorized Signatory of Bidder]
Date: Name:
Designation:
Seal:

Form F-9

PROFORMA OF BANK GUARANTEE FOR CONTRACT PERFORMANCE SECURITY

(*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:

Himachal renewable limited
C/o Himachal Pradesh State Electricity Board Ltd
Vidyut Bhawan Shimla
Shimla, Himachal Pradesh – 171004

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)* …….

By this Bank Guarantee, 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 payment to you up to ……. i.e., ten percent (10%) of the Contract Price until ninety (90) days beyond the Defect Liability Period i.e., upto and inclusive of ……. *(dd/mm/yy)*.

We undertake to make payment under this Bank Guarantee upon receipt by us of your first written demand signed by your duly authorized officer or authorized officer of the Owner declaring the Contractor to be in default under the Contract and without cavil or argument any sum or sums within the above-named limits, without your need to prove or show grounds or reasons for your demand and without the right of the Contractor to dispute or question such demand.

Our liability under this Bank Guarantee shall be to pay to you whichever is the lesser of the sum so requested or the amount then guaranteed hereunder in respect of any demand duly made hereunder prior to expiry of the Bank Guarantee, without being entitled to inquire whether or not this payment is lawfully demanded.

This Bank Guarantee shall remain in full force and shall be valid from the date of issuance until ninety (90) days beyond the Defect Liability Period of the Facilities i.e. upto and inclusive of …… *(dd/mm/yy)* and shall be extended from time to time for such period (not exceeding one year), as may be desired by M/s Solar Energy Corporation of India Limited on whose behalf this Bank Guarantee has been given.

Except for the documents herein specified, no other documents or other action shall be required, notwithstanding any applicable law or regulation.

Our liability under this Bank Guarantee shall become null and void immediately upon its expiry, whether it is returned or not, and no claim may be made hereunder after such expiry or after the aggregate of the sums paid by us to you shall equal the sums guaranteed hereunder, whichever is the earlier.

All notices to be given under shall be given by registered (airmail) posts to the addressee at the address herein set out or as otherwise advised by and between the parties hereto.

We hereby agree that any part of the Contract may be amended, renewed, extended, modified, compromised, released or discharged by mutual agreement between you and the Contractor, and this security may be exchanged or surrendered without in any way impairing or affecting our liabilities hereunder without notices to us and without the necessity for any additional endorsement, consent or guarantee by us, provided, however, that the sum guaranteed shall not be increased or decreased.

No action, event or condition which by any applicable law should operate to discharge us from liability hereunder shall have any effect and we hereby waive any right we may have to apply such law so that in all respects our liability hereunder shall be irrevocable and, except as stated herein, unconditional in all respects.

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_____

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.

3. The Bank Guarantee should be in accordance with the proforma as provided. However, in case the issuing bank insists for additional paragraph regarding applicability of ICC publication No: 758, the following may be added at the end of the proforma of the Bank Guarantee [*i.e., end paragraph of the Bank Guarantee preceding the signature(s) of the issuing authority(ies) of the Bank Guarantee*]:

   "This Guarantee is subject to Uniform Rules for Demand Guarantee, ICC publication No. 758 except that article 15(a) is hereby excluded."

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)
D - 3, 1st Floor, Wing - A, Prius Platinum Building
District Centre, Saket, New Delhi - 110 017

Sub: Bid for ""Tender for Design, Engineering, Supply, Construction, Erection, Testing, Commissioning including 5 Years Plant O&M of 2 MW (AC) Solar PV Power Plant with 01 MW BESS at KAZA, Himachal Pradesh".

Dear Sir / Madam,

Sl. No	Description of the Services	LOA /WO No. and date	Full Postal Address & phone nos. of Client. *Name, designation and address of Engineer/ Officer-in-Charge (for cases other than purchase)*	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

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)
D - 3, 1st Floor, Wing - A, Prius Platinum Building
District Centre, Saket, New Delhi - 110 017

Sub: Bid for ""Tender for Design, Engineering, Supply, Construction, Erection, Testing, Commissioning including 5 Years Plant O&M of 2 MW (AC) Solar PV Power Plant with 01 MW BESS at KAZA, Himachal Pradesh".

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. (FY 16-17 or FY 2017-18).Please tick whichever is applicable

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.

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 permitted assigns) 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 permitted assigns) 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 and permitted assigns) 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 D-3, 1st Floor, Wing-A, Prius Platinum Building, District Centre, Saket, New Delhi-110017 (hereinafter called the "Executing Agency").

WHEREAS the Party No.1, Party No.2 and Party No.3 have entered into an Agreement dated.....

AND WHEREAS the Executing Agency 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 Executing Agency 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:

1. In requirement of the award of the Contract by the Executing Agency/Owner 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 Executing Agency 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 Executing Agency 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 Executing Agency, on its demand without any demur. It shall not be necessary or obligatory for the Executing Agency to proceed against Lead Partner to these presents before proceeding against or dealing with the other Party(ies), the Executing Agency 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 Executing Agency.

4. The financial liability of the Parties of this Deed of Undertaking to the Executing Agency, 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 Executing Agency 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 Executing Agency 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.

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 ……..

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.-3
For and on behalf of M/s. ……..

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.

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, D-3, 1st Floor, Wing-A, Prius Platinum Building, District Centre, Saket, New Delhi-110017 (hereinafter called the 'Executing Agency') to undertake the following acts:

i) To submit proposal and participate in the aforesaid Bid Specification of the Executing Agency on behalf of the "Joint Venture".

ii) To negotiate with the Executing Agency the terms and conditions for award of the Contract pursuant to the aforesaid Bid and to sign the Contract with the Executing Agency 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 Executing Agency 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.

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.

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 permitted assigns) 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 permitted assigns) 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 and permitted assigns) 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 D-3, 1st Floor, Wing-A, Prius Platinum Building, District Centre, Saket, New Delhi-110017 (hereinafter called the "Executing Agency").

WHEREAS the Party No.1, Party No.2 and Party No.3 have entered into an Agreement dated.....

AND WHEREAS the Executing Agency 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 Executing Agency 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:

1. In requirement of the award of the Contract by the Executing Agency 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 Executing Agency 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 Executing Agency 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 Executing Agency, on its demand without any demur. It shall not be necessary or obligatory for the Executing Agency to proceed against Lead Partner to these presents before proceeding against or dealing with the other Party(ies), the Executing Agency 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 Executing Agency.

4. The financial liability of the Parties of this Deed of Undertaking to the Executing Agency, 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 Executing Agency 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 Executing Agency 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.

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 ……..

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.-3
For and on behalf of M/s. ……..

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 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 "Authorised 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, D-3, 1st Floor, Wing-A, Prius Platinum Building, District Centre, Saket, New Delhi-110017 (hereinafter called the 'Executing Agency') to undertake the following acts:

i) To submit proposal and participate in the aforesaid Bid Specification of the Executing Agency on behalf of the "Consortium".

ii) To negotiate with the Executing Agency the terms and conditions for award of the Contract pursuant to the aforesaid Bid and to sign the Contract with the Executing Agency 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 Executing Agency 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

.....

.....

.....

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.

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)

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)
D - 3, 1st Floor, Wing - A, Prius Platinum Building
District Centre, Saket, New Delhi - 110 017

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 Executing Agency 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 Executing Agency without cavil 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 Final commissioning of the project 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 final commissioning of the project by the Executing Agency 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_____

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.

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

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)

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)
(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).

SECTION – V

SCOPE OF WORKS

(NIT No. – SECI/C&P/KAZA/072018)

On behalf of

Himachal Renewable Limited

By:

SOLAR ENERGY CORPORATION OF INDIA LIMITED

(A Government of India Enterprise)

Ist floor, Wing A, Prius Building, D – 3, District Centre, Saket, New Delhi – 110017

Tel: 011 – 71989290, Fax: 011 – 71989241

1 Introduction

1.1 Project Particulars:

Particulars	Description
Design & Engineering	
Capacity of the solar PV power plant	2 MW (AC)
Capacity of Battery Energy Storage System (BESS)	1 MW Power rating & 1 MWh Energy Rating
Technology	(Mono/ Multi crystalline)
O&M Period	5 Years
Design life of PV Power plant	25 years
Location/Site Details	
Location	32°14'27.46"N, 78° 2'25.47"E Rangreek, Near Rong Tong Hydro Power Station, District – Lahaul and Spiti, Himachal Pradesh (Refer Annexure-A)
Type of Land	Government
Ownership	
District	Lahaul and Spiti
State	Himachal Pradesh
Electrical Interconnection Details	
Nearest Substation Details	
Distance to connecting substation	
Access	
Nearest Urban Area	Kaza
Nearest Highway	
Nearest Railway Station	Jogindernagar
Nearest Domestic Airport	Bhuntar
Performance Parameters	
Minimum values of PR and CUF of the plant after netting off the auxiliary consumption.	PR : 0.80 & CUF : 21%
Other Details	
Water and Power for Construction	To be arranged by the Contractor

Scope of Supply and Work

2 Brief Scope of Work

Scope of Supply & Work includes all 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 Grid Interactive Solar PV Power Plant with BESS and performance demonstration with associated equipment and materials on turnkey basis at Rangreek, Lahaul and Spiti District of Himachal Pradesh and 05 (Five) years comprehensive operation and maintenance from the date of Operational Acceptance.

3 Design and Engineering

3.1 Contractor shall prepare the detailed design basis report (DBR) along with relevant standards (with respective clause description), PERT Chart and MDL. Contractor shall submit a copy to Employer for evaluation.

3.2 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
- GTP & G.A. drawings for all types of structures/ components, protection switchgears & 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 and plan for the area
- Overall plant layout
- GA drawings of the entire project including equipment rooms/ inverter control rooms, office cum control room, roads, storm water drainage, sewage networks, security gate, fire protection system, fencing/ boundary wall etc.
- Transmission line drawings and erection plans as per DISCOM/STU guidelines
- Quality assurance plans for manufacturing (MQP) 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 manuals for major equipment

- As-built drawings / documents and deviation list from good for construction (GFC)

3.3 Estimation of the plant generation based on Solar Radiation and other climatic conditions prevailing at site.

3.4 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.

3.5 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 & Supply

4.1 The equipment and materials for Grid Interactive Solar PV Power Plant and BESS with associated system (Typical) shall include but not limited to the receipt, unloading, storage, erection, testing and commissioning of all supplied material for the following:

4.1.1 Adequate capacity of Solar PV modules of suitable rating including module mounting structures (fixed or trackers), fasteners, MMS foundation and module interconnection.

4.1.2 Array Junction boxes, distribution boxes and Fuse boxes: MCBs/ isolators, Surge Arrestors with string monitoring capabilities and with proper lugs, glands, ferrules, terminations and mounting structures.

4.1.3 DC and AC cables of appropriate sizes with adequate safety and insulation

4.1.4 Power Conditioning Units (PCU) with SCADA compatibility, common AC power evacuation panel with bus bars and circuit breakers LT & HT Power Interfacing Panels, Plant Monitoring Desk, AC & DC Distribution boards.

4.1.5 Containerized BESS comprising of unit batteries, battery management system (BMS), auxiliaries, such as HVAC and fire suppression systems, step-up transformers to match utility grid, ac switchgear, Control Systems etc. with Power and Energy ratings as specified.

4.1.6 Step – up transformers (inverter duty) in relevance with state grid code and inverter manufacturer requirements.

4.1.7 Auxiliary transformer (s) for internal consumption.

4.1.8 Metering and protection system along with battery system.

4.1.9 LT Power and Control Cables including end terminations and other required accessories for both AC & DC power.

4.1.10 Internal 415V interconnection & Indoor feeder panels to cater auxiliary needs of plant

4.1.11 Indoor switchgear and panels having incoming and outgoing feeders with VCBs, CTs, PTs, Bus bars, cables terminals kits and bus section panel. The control and relay panel should form integral part of the switchgear (i.e. should be physically integrated into one unit). The switchgear will be installed in a separate switchgear room.

4.1.12 ABT meters (Main and Check) with all necessary metering rated CT's and PT's at the plant take off point as well as at the substation as per CEA Metering Regulation 2006 as amended time to time and state metering code.

4.1.13 Data acquisition system with remote monitoring facilities. Provision for specific data transfer to the State Load Dispatch Centre (SLDC) shall also be provided.

4.1.14 Lightning arrestors for entire plant area.

4.1.15 PVC pipes, cable conduits, cable trays and accessories/trenches.

4.1.16 Earthing of the entire plant as per relevant standards.

4.1.17 Control room equipment

4.1.18 Testing instruments for maintenance and monitoring of equipment.

4.1.19 Spares & consumables, as required or recommended, for the complete O&M period.

4.1.20 CCTV cameras for plant surveillance

4.1.21 Fire protection system in buildings and fire extinguishers.

4.1.22 Weather monitoring station shall include but not be limited to the following:

- Pyranometers – for horizontal and tilted plane
- Ultrasonic Anemometer (wind speed and direction)
- Temperature Sensor – Ambient and module surface
- Power source to the all sensors
- Data Logger

4.1.23 Construction of suitable structures for termination of transmission line for taking off from plant end and receipt of lines at Substation end.

4.1.24 Design & construction of Transmission line/ cable from plant take off point to the designated substation including right of way (ROW).

4.1.25 Materials and accessories, which are required for satisfactory and trouble-free operation and maintenance of the above equipment.

4.1.26 Any other equipment / material, not mentioned but required to complete the Solar Power Plant facilities in all respect.

5 Construction and Erection Works

5.1 The items of civil design and construction work shall include all works required for solar PV project and should be performed specifically with respect to following but not limited to:

5.1.1 Conducting geotechnical investigation and topographical survey of the total area.

5.1.2 Earthwork for site grading, cutting, filling, levelling & compaction of land.

5.1.3 Construction and erection of perimeter fence/ boundary wall and main/ security gate(s).

5.1.4 Construction of foundation for mounting structures for SPV panels.

5.1.5 Civil foundation work of transformers, switchgears, etc.

5.1.5 Civil foundation work and structure designs for BESS.

5.1.6 Construction of motorable approach road, internal roads with WBM base

5.1.7 Construction of Equipment room with necessary illumination system and finishing as required.

5.1.8 Office cum stores cum control room building with Supervisor room, pantry, wash room, conference room etc. along with requisite furniture, workstations, air conditioning, internal and external illumination, other equipment as per the specifications.

5.1.9 Security cabin (s) at strategic locations inside the boundary of the plant.

5.1.10 Suitable arrangement of water shall be ensured to cater to day-to-day requirement of drinking water and permanent water supply for module cleaning and other needs of SPV power Plant during entire O&M period.

5.1.11 Suitable Communication System for SCADA with remote monitoring capabilities and internet facility.

5.1.12 Construction of Storm water drainage & sewage network including Rain water harvesting mechanism.

5.1.13 Erection of Perimeter lighting along with all accessories and cabling

5.1.14 Laying of underground / over ground Cables (all types) with proper arrangements along with appropriate sized ferrules, lugs, glands and terminal blocks. Laying of cables inside the building trench and other locations as required shall be over GI cable trays with proper support and accessories

5.1.15 Construction of transmission line, from take-off point at plant to the delivery point at STU/DISCOM substation.

5.1.16 Suitable earthing for plant along with earth pits as per standards

5.1.17 All approvals, for equipment, items and works, which are not otherwise specifically mentioned in this document but are required for successful completion of the work in all aspects, including construction, commissioning, O&M of Solar PV Power Plant and guaranteed performance are deemed to be included in the scope of the contractor.

6 Statutory Approvals

6.1 Obtaining statutory approvals /clearances on behalf of the Employer from various Government Departments, not limited to, the following.

6.1.1 Pollution control board clearance, if required

6.1.2 Mining Department, if required

6.1.3 Forest Department, if required

6.1.4 All other approval, as necessary for setting up of a solar power plant including CEIG/ CEA, connectivity, power evacuation, railways, PTCC etc. as per the suggested guidelines

6.1.5 All other statutory approvals and permissions, not mentioned specifically but are required to carry out hassle free Construction and O&M of the plant prevailing at Site.

6.1.6 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.

6.2 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 whereto and rules made there under or amended from time to time.

7 Operation and Maintenance

7.1 Total Operation & Maintenance of the Plant and Equipment shall be with the Contractor, after commissioning of the plant till final acceptance which shall include deployment of engineering personnel, technicians and security personnel.

7.2 To provide a detailed training plan for all O&M procedures to Employer’s nominated staff, which shall have prior approval from the Employer.

7.3 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.

7.4 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.

7.5 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.

7.6 Procurement of spare parts, overhaul parts, tools & tackles, equipment, consumables, etc. required for smooth operation and maintenance of the Plant and Equipment as per prudent/ standard utility practices, OEM recommendations and warranty clauses for the entire O&M period

7.7 To upkeep all administrative offices, roads, tool room, stores room, equipment, clean, green and in workable conditions.

7.8 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.

7.9 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.

7.10 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.

7.11 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 STU/SLDC/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.
- Furnishing generation data monthly to Employer 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

7.12 Continuous monitoring the performance of the Plant and Equipment 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.

7.13 Preventive and corrective O&M of the Plant and Equipment 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.

7.14 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 Plant and Equipment 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 period of minimum 5 years.

7.15 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.

7.16 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 shoes etc.

8 Operation and Performance Monitoring

8.1 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.

8.2 Daily work of the operation and maintenance in the Solar Photovoltaic Power Plant involves periodic cleaning of Modules, 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.

8.3 Earth resistance of Plant as well as individual earth pit is to be measured and recorded every month. If the earth resistance is high suitable action is to be taken to bring down the same.

8.4 A maintenance record is to be maintained by the operator/engineer-in-charge to record the regular maintenance work carried out as well as any breakdown maintenance along with the date of maintenance reasons for the breakdowns steps have taken to attend the breakdown duration of the breakdown etc.

8.5 The 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. An information shall be provided to Engineer-in-charge for such operation prior to start.

8.6 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) at O&M period, the Contractor shall immediately report the accidents, if any, to the Engineer In-charge showing the circumstances under which it happened and the extent of damage and or injury caused.

8.7 The contractor shall at his own expense provide all amenities to his workmen as per applicable laws and rules.

8.8 If negligence / mal operation of the contractor's operator results in failure of equipment such equipment should be repaired replaced by contractor at free of cost.

9 Security services

9.1 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. The security staff may be organized to work on suitable shift system; proper checking & recording of all incoming & outgoing materials vehicles shall be maintained. Any occurrence of unlawful activities shall be informed to Employer immediately. A monthly report shall be sent to Employer on the security aspects.

9.2 All the information shown here is indicative only and may vary as per design and planning by the bidder. The bidder must provide the BOM of the plant as per the design during the time of bidding. The technical features of major equipment are described in Section – VI TECHNICAL SPECIFICATIONS.

SECTION – VI

TECHNICAL SPECIFICATIONS

(NIT No. – SECI/C&P/KAZA/072018)

On behalf of

Himachal Renewable Limited

By:

SOLAR ENERGY CORPORATION OF INDIA LIMITED

(A Government of India Enterprise)

I[st] floor, Wing A, Religare Building, D – 3, District Centre, Saket, New Delhi – 17

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DISCLAMIER:

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(s), reserve 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 specification 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 is 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 for the site conditions and directed to achieve the maximum output form 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:

(Signature)

Date: Name and Designation of bidder

1 Design Philosophy

1.1 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 system.

1.1.1 Adequate capacity of SPV module, PCUs, Junction boxes, battery storage 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 loss, system losses, site conditions etc.

1.1.2 Use of equipment and systems with proven design and performance that have a high availability track record under similar service conditions.

1.1.3 Selection of the equipment and adoption of a plant layout to ensure ease of maintenance.

1.1.4 Strict compliance with the approved and proven quality assurance (QA) systems and procedures during the different stages of the project starting from sizing, selection of make, shipment, storage (at site), during erection, testing and commissioning.

1.1.5 Proper monitoring of the synchronization and recording which ensures the availability of power to the grid.

1.1.6 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.

1.1.7 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.

1.1.8 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.

1.2 The basic and detailed engineering of the plant shall aim at achieving high standards of operational performance especially considering following:

1.2.1 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.

1.2.2 SPV arrays are commonly held fixed at an optimum tilted angle and face towards the equator. Trackers can also be used for tracking the sun on daily or seasonal basis. In case of fixed tilt, the tilt angle so defined for the array so that optimum generation is achieved at all times.

1.2.3 Shadow free plant layout to ensure minimum loss in generation during the day time.

1.2.4 Higher DC system voltage and lower current options to be followed to minimize ohmic losses.

1.2.5 Selection of PCUs with proven reliability and minimum downtime. Ready availability of requisite spares.

1.2.6 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.

1.2.7 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.

1.2.8 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.

1.2.9 Bidder shall design the plant and equipment in order to have sustained life of 25 years with minimum maintenance efforts.

1.2.10 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.

1.3 All documents and drawings shall be submitted to the Employer both in soft as well as hard copies (3 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 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-IVR: 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)

1.4 After LOA, the Contractor shall submit complete Master Document & Drawing list (MDL) to the Employer within 1 week. The MDL shall list all the Drawings & Documents envisaged for submission/ approval from the Employer and shall also have all the required information like drawing no (both vendor and Employer's drawing no), title, scheduled date of submission, actual date of submission and approval. The category of approval shall be decided mutually between Contractor and the Employer at the time of finalization of the MDL which shall be the basis for drawing & document approval process during project execution.

1.5 The construction shall be done only as per drawings approved under Category – I, II & IV.

1.6 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.

Electrical System (DC & AC systems)

2 Photovoltaic Modules

2.1 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 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 (Applicable for coastal and marine environment)

IEC 62716:2013 Ed.1	Photovoltaic (PV) modules - Ammonia corrosion testing
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.	

2.2 Technical Requirements

Parameter	**Specification**
Cell type	Mono-crystalline or Multi-crystalline
Rated power at STC	No negative tolerance is allowed
DC Overloading to be considered over rated Plant AC Capacity	0%
Module Efficiency	More than 18% for mono-crystalline More than 16% for multi-crystalline
Temperature co-efficient of power	Not more than 0.4%/°C
Wind speed	Suitable for site condition or as per IS:875 Part-3 whichever is higher
Application Class as per IEC 61730	Class A

2.3 Component Specifications

2.3.1 The glass used to make the PV modules shall be toughened low iron glass with minimum thickness of 4.0 mm for 72 cell module and 3.2 mm for 60 cell module. The glass used shall have transmittance of above 90%.

2.3.2 The back sheet used in the PV modules shall be of three layered structure durable for humidity – hot conditions with properties of moisture barrier, elongation retention and UV resistance. 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	≥ 1000 V / 1500 V
Elongation at break	> 100%
Adhesion strength with encapsulant	> 70 N/cm

Interlayer adhesion strength	> 5 N/cm

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.

2.3.3 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	> 1×10^{15} Ω.cm
Peeling strength with glass	> 60 N/cm

2.3.4 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.

2.3.5 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.

2.3.6 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 IP67. 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 Cu 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.

2.3.7 Each PV Module shall be provided a bar code which is embedded inside the module lamination and must be able to withstand harsh environmental conditions. The bar code data base shall contain the following information. Bar code 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)
(vi) I-V curve for the module
(vii) Peak Wattage, Im, Vm 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.

2.4 Warranty

2.4.1 PV modules must be warranted with linear degradation rate of power output except for first year (maximum 2.5% including LID) and shall guarantee 80% of the initial rated power output at the end of 25 years.

2.4.2 The modules shall be warranted for minimum of 10 years against all material/ manufacturing defects and workmanship.

2.4.3 The above warranties shall be backed by third party insurance.

2.5 Approval

2.5.1 The Contractor shall provide Guaranteed Technical Particular 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.

2.5.2 The Contractor shall also provide test certifications corresponding to the standards mentioned above along with complete test reports. 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.

2.5.3 The BOM proposed shall be the subset of Constructional Data Form (CDF)'s of all the test reports.

2.5.4 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.

2.5.5 The Contractor shall obtain the approval of the proposed module make and model prior to manufacturing/ inspection call.

2.6 Manufacturing and Inspection

2.6.1 The Contractor shall inform the module manufacturing schedule to the Employer at least 7 (seven) working days before the start of proposed schedule.

2.6.2 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.

2.6.3 The Manufacturing shall start only after the clearance by the Employer after the material inspection.

2.6.4 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.

2.6.5 The modules shall be uniformly laminated without any lamination defects.

2.6.6 Current binning of modules shall be employed so that current mismatch of modules in a pallet does not exceed 0.1 A. Different colour codes shall be provided on the modules as well as pallet for identification of different bins.

2.6.7 Pre-dispatch inspection of modules shall be performed as per the inspection protocol attached in Annexure – B.

2.7 Transportation, Handling, Storage and Installation

2.7.1 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.

2.7.2 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.

2.7.3 The stacked modules, in any case, shall be stacked as per the manufacturer's recommendation only and shall be covered with tarpaulin sheet.

3 String Monitoring Unit

3.1 Standards and Codes

Standard/Code	Description
IEC 60529	Enclosure Ingress Protection
IEC 62262	Enclosure Impact Protection
IEC 60296	Fuse
IEC 61643-11	Surge Protection Device
IEC 62852 or EN 50521	Solar cable connector
IEC 60695-2-11	Fire hazard testing

3.2 Construction

3.2.1 Enclosure shall be made of UV resistant, fire retardant, thermoplastic material. Enclosure degree of protection shall be at least IP65 and mechanical impact resistance shall be at least IK08.

3.2.2 Not more than two strings can be connected in parallel to a single input of SMU. One spare input terminal along with connector shall be provided for each SMU.

3.2.3 Every SMU input shall be provided with fuses on both positive and negative side. 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.

3.2.4 DC disconnector switch of suitable rating shall be provided at SMU output to disconnect both positive and negative side simultaneously.

3.2.5 Type-II surge protective device (SPD) conforming to IEC 61643-11 shall be connected between positive/negative bus and earth.

3.2.6 Resistance Temperature Detector (RTD) type or semiconductor type temperature sensor shall be provided to monitor the cabinet temperature.

3.2.7 MC4 connector conforming to IEC 62852 or EN 50521 shall be provided at each SMU input. Cable gland (double compression metallic) of suitable size for DC cables shall be provided at the SMU output.

3.2.8 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.

3.2.9 Suitable communication interface shall be provided to communicate the data to SCADA. The following parameters shall be measured/ monitored and made available at SCADA.

(i) String current
(ii) Bus voltage
(iii) Output current
(iv) Cabinet temperature
(v) DC disconnector switch ON/OFF status
(vi) SPD operating status

3.2.10 The Contractor shall submit busbar sizing calculation for specified continuous and short time current ratings during detailed engineering.

3.3 Warranty

The SMU unit shall be warranted for minimum of 5 (five) years against all material/ manufacturing defects and workmanship.

3.4 Approval

3.4.1 Documents/Drawings

(i) Guaranteed Technical Particular (GTP) Datasheet.
(ii) Bill of Materials for the proposed SMU along with the datasheet of each component
(iii) General Arrangement (GA) drawing
(iv) Quality Assurance Plan (QAP)

3.4.2 Test Certificates/Reports

(i) Test certificates of fuse, SPD and solar cable connector

(ii) Enclosure ingress protection and impact protection test certificates

3.5 Tests

Routine tests and acceptance tests for the assembled unit shall be as per the Quality Assurance Plan (QAP) approved by the Employer.

4 Solar and DC Cables

4.1 Standards and Codes

Cable	From	To	Conductor/ Insulation	Voltage Rating	Applicable Standard
Solar Cable*	Module	SMU	Copper/ XLPO	1.1 kV DC / 1.5 kV DC	IEC 62930/ EN 50618/
DC Cable	SMU	Power Conditioning Unit	Copper or Aluminium/ XLPE	1.1 kV DC / 1.5 kV DC	IS 7098 Part I
* Cable used for module interconnection shall also be referred as solar cable.					

4.2 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.

4.3 DC cables shall be single core, armoured, Flame Retardant Low smoke (FRLS), PVC outer sheath conforming to IS 7098-I. DC cable with positive polarity should have marking of red line on black outer sheath.

4.4 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

4.5 Cables shall be sized based on the following considerations:

(i) Rated current of module

(ii) The average voltage drop in the cables (Modules to Inverter) shall be limited to 1.5 % of the rated voltage. Contractor shall provide voltage drop calculations in excel sheet.

(iii) Short circuit withstand capability

(iv) De-rating factors according to laying pattern

4.6 Warranty

The cables (Solar and DC) shall be warranted for minimum of 1 (one) year against all material/ manufacturing defects and workmanship.

4.7 Approval

4.7.1 Documents/Drawings

(i) Guaranteed Technical Particular (GTP) Datasheet.

(ii) Solar and DC Cable sizing calculation

(iii) Quality Assurance Plan (QAP)

4.7.2 Test Certificates/Reports

(i) Solar cable type test certificate as per IEC 62930/EN 50618

(ii) DC cable type test certificate as per IS 7098-1

4.8 Tests

Routine test and acceptance tests requirements shall be as per IEC 62930/EN 50618 for solar cables and IS 7098-1 for DC cables.

4.9 Installation

4.9.1 Cable installation shall be as per IS 1255.

4.9.2 Only terminal cable joints shall be accepted. No cable joint to join two cable ends shall be accepted.

4.9.3 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.

4.9.4 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.

4.9.5 Solar cables, wherever exposed to direct sunlight and buried underground, 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.

4.9.6 Solar cables shall be aesthetically tied to Module Mounting Structure using UV resistant cable-ties suitable for outdoor application.

4.9.7 A.C. and D.C. cables shall be kept in separate trenches.

4.9.8 The horizontal and vertical clearances between power and communication cables shall not be less than 300 mm.

5 Power Conditioning Unit

5.1 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 61727:2004 Ed. 2	Photovoltaic (PV) systems - Characteristics of the utility interface
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 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.	

5.2 Technical Requirements

Parameter	Specification
Rated AC power	As per design
Maximum input voltage	1000 V / 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	IP 20 (Indoor)/IP 54 (Outdoor)

5.2.1 The rated/ name plate AC capacity of the PCU shall be AC power output of the PCU at 25°C.

5.2.2 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.

5.2.3 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.

5.3 Construction

5.3.1 Power Conditioning Unit (PCU) shall consist of an electronic three phase inverter along with associated control, protection, filtering, measurement and data logging devices.

5.3.2 Every DC input terminal of PCU shall be provided with fuse of appropriate rating. The combined DC feeder shall have suitably rated isolators for safe start up and shut down of the system.

5.3.3 Type-II surge protective device (SPD) conforming to IEC 61643-11 shall be connected between positive/ negative bus and earth.

5.3.4 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.

5.3.5 Circuit Breaker of appropriate voltage and current rating shall be provided at the output to isolate the PCU from grid in case of faults.

5.3.6 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.

5.3.7 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.

5.3.8 Dedicated communication interface shall be provided to monitor the PCU from SCADA.

5.3.9 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
(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

5.4 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.

5.4.1 Standby Mode

The PCU shall continuously monitor the input DC voltage and remain on Standby Mode until it reaches the pre-set value.

5.4.2 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.

5.4.3 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.

5.5 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 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

5.6 Grid Support Functions

5.6.1 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 the 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.

5.6.2 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.

5.6.3 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.

5.7 Warranty

The complete Power Conditioning Unit shall be warranted for minimum of 5 (five) years against all material/ manufacturing defects and workmanship.

5.8 Approval

5.8.1 Documents/Drawings

(i) Guaranteed Technical Particular (GTP) Datasheet.
(ii) General Arrangement (GA) drawing and Foundation details

(iii) Single Line Diagram and Bill of Materials

(iv) Transformer Requirements

(v) Quality Assurance Plan (QAP)

5.8.2 Test Certificates/Reports

All the test certificates as per the standards mentioned above shall be submitted for approval. 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. It is the responsibility of the Contractor to substantiate the compliance for CEA Regulations using test reports.

5.9 Tests

Routine tests and acceptance tests shall be as per the Quality Assurance Plan (QAP) approved by the Employer.

6 Inverter Transformer and Auxiliary Transformer

6.1 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	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

6.2 Technical Requirements

Parameters	**Inverter Transformer**	**Auxiliary Transformer**
VA Rating	1 MVA (2 nos.)	As per system design
Voltage Ratio	22 kV/ Inverter output voltage	As per system design
Duty, Service & Application	Continuous Solar Inverter application and converter Duty (Outdoor)	Continuous application (Outdoor/Indoor)
Winding	2	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	50°C
Winding	55°C	55°C
SC withstand time (thermal)	2 second	2 second
Fault Level & Bushing CT	As per system design requirement of grid utility	
Termination	As per system requirement	
Bushing rating, Insulation class (Winding & bushing)	HV side - 24 kV porcelain bushings LV side – 1.1 kV porcelain bushings	
Rated Short Duration Power Frequency Withstand Voltage (rms)	50 kV	
Rated Lightning Impulse Withstand Voltage (peak)	125 kV	
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

6.3 Construction

6.3.1 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.

6.3.2 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.

6.3.3 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.

6.3.4 The transformer shall be suitable for continuous operation with a frequency variation of ± 2.5% from nominal frequency of 50 Hz without exceeding the specified temperature rise.

6.3.5 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.

6.3.6 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.

6.3.7 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.

6.3.8 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.

6.3.9 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 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.

6.3.10 Buchholz relay, double float type with alarm and trip contacts, along with suitable gas collecting arrangement shall be provided.

6.3.11 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.

6.3.12 Filter valve at top the tank and drain cum sampling valve at bottom of the tank shall be provided.

6.3.13 All external surface of the transformer shall be painted with two coats of epoxy-based paint of colour shade RAL 7032. 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 micron.

6.3.14 LV and HV cable box shall be provided with disconnecting chamber to facilitate the movement of transformer without disturbing cable box and termination.

6.3.15 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.

6.3.16 Rain hoods to be provided on Buchholz, MOG & PRD. Entry points of wires shall be suitably sealed.

6.3.17 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.

6.3.18 Fire-protection for inverter transformer shall be provided in accordance with relevant CEA regulations as amended time to time.

6.4 Warranty

The transformer shall be warranted for minimum of 5 (five) years against all material/ manufacturing defects and workmanship.

6.5 Approval

6.5.1 Documents/Drawings

(i) Guaranteed Technical Particular (GTP) Datasheet.

(ii) General Arrangement (GA) Drawing of complete transformer, cable boxes, marshalling box

(iii) Foundation details

(iv) Rating plate and Valve schedule plate

(v) Marshalling box wiring diagram

(vi) Manufacturer acceptance for inverter requirements

(vii) Quality Assurance Plan (QAP)

6.5.2 Test Certificates/Reports

Type test and Special test reports as mentioned in the following clause shall be submitted for approval.

6.6 Testing and Inspection

6.6.1 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.

A. Type Tests

(i) Lightning impulse (Full & Chopped Wave) test on windings as per IEC 60076-3

(ii) Temperature Rise test at a tap corresponding to maximum losses as per IEC 60076-2

B. Special Tests

(i) Measurement of zero-sequence impedance as per IEC 60076-1

(ii) Measurement of harmonics of no-load current as per IEC 60076-1

(iii) Measurement of acoustic noise level as per NEMA TR-1

(iv) Short-circuit withstand test as per 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.

6.6.2 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

(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

6.6.3 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.

7 HT Switchgear

7.1 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
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

7.2 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
Circuit Breaker	
Type	Vacuum type
Operating duty cycle	O – 0.3sec – CO – 3min – CO
Short circuit breaking current	As per system requirement
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

7.3 Switchgear Panel

7.3.1 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.

7.3.2 The circuit breakers shall be mounted on horizontally withdrawable trucks with locking facility in SERVICE and TEST positions.

7.3.3 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.

7.3.4 All external surface shall be painted with two coats of epoxy-based paint of colour shade RAL 7032. Internal surface shall be painted with epoxy enamel white paint. The minimum dry film thickness (DFT) shall be 100 micron.

7.3.5 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 provided with neoprene/synthetic rubber gaskets to prevent entry of vermin and dust.

7.3.6 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.

7.3.7 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.

7.3.8 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.

7.3.9 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.

7.3.10 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.

7.3.11 240 V, 5 A, SPN industrial socket-outlet with ON/OFF switch shall be provided in each panel.

7.3.12 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.

7.3.13 Gapless, metal-oxide surge arrestors shall be provided between line and earth in cable compartment of the switchgear panel.

7.3.14 Suitable lifting hooks shall be provided for each panel.

7.4 Circuit Breakers

7.4.1 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.

7.4.2 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 anti-pumping feature.

7.4.3 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.

7.4.4 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.

7.4.5 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.

7.4.6 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.

7.5 Relays

7.5.1 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.

7.5.2 Auxiliary voltage of the relays shall be 110 VDC and the relays shall be capable of operating continuously between 80 – 120% of auxiliary voltage.

7.5.3 All numerical relays shall have adequate number of freely configurable, optically isolated, Binary Inputs (BI) and potential free Binary Outputs (BO).

7.5.4 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.

7.5.5 All I/O's shall have galvanic isolation. Analog inputs shall be protected against switching surges and harmonics.

7.5.6 Making, breaking and continuous capacity of the relay contacts shall be adequate enough for the circuits in which they are used.

7.5.7 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

7.5.8 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

7.5.9 All numerical relays shall have provision for measurement and storage of electrical parameters such as voltage, current, frequency, active power, reactive power etc.

7.5.10 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.

7.5.11 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.

7.5.12 The numerical relay shall have self-diagnostic feature with separate output contact for indication of any internal relay failure.

7.5.13 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 system.

7.5.14 The numerical relay shall have feature for time synchronization through the SCADA System / networking.

7.5.15 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.

7.6 Instrument Transformers

7.6.1 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.

7.6.2 Polarity marks shall indelibly be marked on each instrument transformer and at the lead terminals at the associated terminal block.

7.6.3 Voltage transformers shall be single phase units. Bus voltage transformers shall be housed in a separate panel on withdrawable truck.

7.6.4 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.

7.7 Earthing

7.7.1 An earth bus made of copper or aluminium 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.

7.7.2 The earth bus shall have sufficient cross section to carry maximum fault current without exceeding the allowable temperature rise.

7.7.3 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.

7.7.4 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.

7.7.5 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 with green colour insulation.

7.7.6 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.

7.7.7 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.

7.7.8 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.

7.8 Bus bar

7.8.1 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.

7.8.2 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.

7.8.3 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.

7.8.4 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.

7.8.5 The Contractor shall submit busbar sizing calculation for specified continuous and short time current ratings during detailed engineering.

7.9 Measuring Instruments

7.9.1 All the measuring instruments shall be digital, flush mounting type with communication facility.

7.9.2 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.

7.9.3 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)

7.10 Wiring and Terminal blocks

7.10.1 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.

7.10.2 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.

7.10.3 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.

7.10.4 The Contractor shall be solely responsible for the completeness and correctness of the internal wiring and for the proper functioning of the connected equipment.

7.10.5 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.

7.10.6 CT and VT secondary circuits shall be terminated on stud type, non-disconnecting terminal

blocks.

7.10.7 At least 10% spare terminals shall be provided on each panel and these spare terminals shall be distributed on all terminal blocks.

7.11 Warranty

The HT panel unit shall be warranted for minimum of 5 (five) years against all material/ manufacturing defects and workmanship.

7.12 Approval

7.12.1 Documents/Drawings

(i) Guaranteed Technical Particular (GTP) Datasheet
(ii) General Arrangement (GA) Drawing and Foundation details
(iii) Schematic diagram
(iv) Bus bar sizing calculation
(v) Bill of Materials
(vi) Quality Assurance Plan (QAP)

7.12.2 Test Certificates/ Reports

Type test reports as mentioned in the following clause shall be submitted for approval.

7.13 Testing and Inspection

7.13.1 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	
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
Electromagnetic Compatibility tests	IEC 61869-3	7.2.5
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.

7.13.2 Routine Tests

Routine tests and acceptance tests shall be as per the Quality Assurance Plan (QAP) approved by the Employer.

8 AC Cables

8.1 Standards and Codes

All AC Cables shall conform to the following standards and codes.

IS 7098	Crosslinked polyethylene insulated PVC sheathed cables, Part 1: For working voltage up to and including 1100 V
IS 7098	Crosslinked Polyethylene Insulated Thermoplastics Sheathed Cables Part 2: for Working Voltages from 3.3 kV up to and Including 33 kV

8.2 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.

8.3 Only terminal cable joints shall be accepted. No cable joint to join two cable ends shall be accepted. However, cable joints may be allowed if the route length is more than maximum available drum length subject to Employer's approval.

8.4 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

8.5 Cables shall be sized based on the following considerations:

(i) Rated current the equipment
(ii) Maximum voltage drop in LT cable (from inverter to inverter transformer) shall be limited to 0.5% of the rated voltage. For HT cables (from inverter transformer to interconnection 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

8.6 Warranty

All cables shall be warranted for minimum of 1 (one) year against all material/ manufacturing defects and workmanship.

8.7 Approval

8.7.1 Documents/Drawings

(i) Guaranteed Technical Particular (GTP) Datasheet

(ii) Cable sizing calculation

(iii) Quality Assurance Plan (QAP)

8.7.2 Test Certificates/ Reports

Type test certificates as per the standards mentioned above shall be submitted for approval.

8.8 Testing

Routine test and acceptance tests requirements shall be as per relevant standards for all cable sizes.

8.9 Installation

8.9.1 Cable installation shall be as per IS 1255.

8.9.2 LT cable (from inverter to inverter transformer) shall laid through RCC cable trench with supports.

8.9.3 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.

8.9.4 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.

9 Auxiliary supply system

9.1 Scheme for Auxiliary supply system shall be submitted by contractor during detailed engineering for the approval by Employer.

9.2 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.

9.3 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

10 Distribution Switchgear

10.1 Standards and Codes

All equipment provided under distribution 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
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

10.2 Technical Parameters

System Details	
Rated system voltage	415V+10%,3 Phase, 50Hz, 4 wire, Neutral Solidly Earthed
Digital Multifunctional Meter (MFM)	
Accuracy class	0.2 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	650V, 50Hz
CT Secondary Current	1 A
Class of insulation	E or better

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)	
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

10.3 Constructional Details

10.3.1 The panel shall be metal enclosed, free standing, floor mounted, modular type with compartmentalized construction having degree of protection of IP 2X (Indoor) as per IS/IEC 60529. All doors and covers shall be provided with neoprene gaskets to prevent entry of vermin and dust.

10.3.2 All switches, push buttons etc. shall be operated front and shall be flush/semi-flush mounted.

10.3.3 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.

10.3.4 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.

10.3.5 Earthing bus bar of suitable cross section shall be provided throughout the length of panel.

10.3.6 The panel shall be duly wired with suitable size of 1.1kV, 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.

10.3.7 The panel shall be painted with 2 coats of primer after pre-treatment and 2 coats of Polyurethane / epoxy paint with shade as decided by the Owner.

10.3.8 The panel shall be of dead front construction suitable for front operated and back maintained functioning.

10.3.9 240 V, 5 A, 3 pin industrial socket-outlet with ON/OFF switch shall be provided in each panel.

10.3.10 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.

10.3.11 Suitable lifting hooks shall be provided for each panel.

10.3.12 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.

10.3.13 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.

10.4 Warranty

Distribution panels (ACDB and DCDB) shall be warranted for minimum of 1 (one) year against all material/ manufacturing defects and workmanship

10.5 Approval

Schematic diagram and General Arrangement (GA) drawing shall be submitted for approval.

10.6 Testing

Routine test and acceptance tests requirements shall be as per relevant standards for all cable sizes.

11 Uninterrupted Power Supply (UPS)

11.1 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

11.2 General Requirements

11.2.1 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

11.2.2 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.

11.3 System Description

11.3.1 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

11.3.2 The UPS shall meet the following minimum specifications.

Parameter	**Specification**
Topology	Online double conversion UPS

Input	
Voltage	415V ± 10% AC
Frequency	50 ± 5 Hz
Power factor	0.95
Output	
Voltage	230V ± 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-232 & RS-485 Interface Port
Overall efficiency	>90%
Electrical Protection	Input/ output under voltage, over temperature, overload, Short circuit, battery low trip

11.3.3 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.

11.3.4 Contractor shall provide the Operation & Maintenance Manual and mandatory spare parts list along with the equipment

11.4 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

11.5 Approval

11.5.1 Documents/Drawings

(i) Technical Datasheet

(ii) UPS sizing calculation

(iii) Single line diagram

(iv) General Arrangement (GA) drawing

(v) Quality Assurance Plan

11.5.2 Test Certificates/Reports

Type test certificates as per the standards mentioned above shall be submitted for approval.

11.6 Tests

11.6.1 Routine tests and acceptance tests on final product shall be done as per QAP approved by the Employer.

11.6.2 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.

12 Metering System

12.1 Standards and Codes

Standard/Code	Description
IEC 62052-11:2003	Electricity metering equipment (AC) - General requirements, tests and test conditions - Part 11: Metering equipment
IEC 62053-22:2003	Electricity metering equipment (AC) - Particular Requirements - Part 22: Static meters for active energy (classes 0,2 S and 0,5 S)
IS 14967	AC Static Transformer Operated Watthour and VAR-hour Meters, Class 0.2 S and 0.5 S

12.2 ABT energy meter shall be provided as approved by state DISCOM under the metering scheme, to measure the delivered quantum of energy to the grid for sale. The responsibility of arranging for the meter, its inspection/ calibration/ testing charges etc. rests with the Contractor. All charges incurred on Meter testing, shall be borne by the Contractor. ABT energy metering system is to be approved by state DISCOM.

12.3 Meter must be provided with the necessary data cables.

12.4 The Contractor shall provide ABT compliant meters at the interface points.

12.5 Interface metering shall conform to the CEA (Installation and Operation Meters) Regulation 2006 and amendment thereof Commercial settlement of solar Photovoltaic Grid Interactive based power project.

12.6 Meter shall be suitable for interfacing for synchronizing the built-in clock of the meter by GPS time synchronization equipment existing at the station either through a synchronization pulse received from the time synchronization equipment or through a remote PC synchronized to GPS clock shall also be in the scope of Contractor.

12.7 All charges for testing and passing of the meter with relevant government agency shall be borne by Contractor, the Employer will assist Contractor for necessary document as and when required. Contractor has to intimate the required documents at least 7 days prior of such requirements.

12.8 ABT compliant Energy Meters shall have technical specification as given below (not limited to specified requirement, Contractor can provide Meter with latest facilities).

12.8.1 Meters shall carry out measurement of active energy (both import and export) and reactive energy (both import and export) by 3-phase, 4-wire principle suitable for balanced/ unbalanced 3 phase load.

12.8.2 Meters shall have an accuracy of energy measurement of at least Class 0.2S for active energy and at least Class 0.5 for reactive energy, and shall be connected to Class 0.2 CT cores and Class 0.2 VT windings or as per state grid regulations. The active and reactive energy shall be directly computed in CT & VT primary ratings.

12.8.3 Meters shall compute the net MWh and MVArh during each successive 15-minute block metering interval along with a plus/ minus sign, instantaneous net MWh, instantaneous net MVARh, average frequency of each 15 minutes, net active energy at midnight, net reactive energy for voltage low and high conditions at each midnight.

12.8.4 Each energy meter shall have a seven digit display unit. It shall display the net MWh and MVARh with a plus/minus sign and average frequency during the previous metering interval; peak MW demand since the last demand reset; accumulated total (instantaneous) MWh and MVARh with a plus/minus sign, date and time; and instantaneous current and voltage on each phase.

12.8.5 All the registers shall be stored in a non-volatile memory. Meter registers for each metering interval, as well as accumulated totals, shall be downloadable. All the net active/reactive energy values displayed or stored shall be with a plus /minus sign for export/import.

12.8.6 At least the following data shall be stored before being over-written for the following parameters.

S. No.	Parameters	Details	Min. No. of days

1	Net MWh	15 min. block	90 days in meter
2	Average Frequency	15 min. block	90 days in meter
3	Net MVARh for > 103%	15 min. block	90 days in meter
4	Cumulative net MWh	At every mid night	30 days in meter/ 90 days in PC
5	Cumulative net MVARh for >103%	At every mid night	30 days in meter/ 90 days in PC
6	Date & time blocks for VT failure on any phase		

12.8.7 The meter shall have a built-in clock and calendar with an accuracy of less than15 seconds per month drift without assistance of external time synchronizing pulse.

12.8.8 Date/time shall be displayed on demand. The clock shall be synchronized by GPS time synchronization equipment existing at the station provided by Contractor.

12.8.9 The meter shall be suitable to operate with power drawn from the VT supplies. The burden of the meters shall be less than maximum 2VA.

12.8.10 The power supply to the meter shall be healthy even with a single- phase VT supply. An automatic backup, in the event of non-availability of voltage in all the phases, shall be provided by a built in long life battery and shall not need replacement for at least 10 years with a continuous VT interruption of at least 2 years. Date and time of VT interruption and restoration shall be automatically stored in a non-volatile memory.

12.8.11 Even under the absence of VT input, energy meter display shall be available and it shall be possible to download data from the energy meters.

12.8.12 Meters shall have an optical port on the front of the meter for data collection from either a hand-held meter reading instrument (MRI) having a display for energy readings or from a notebook computer with suitable software.

12.8.13 The meter shall have means to test MWh and MVARh accuracy and calibration at site in-situ and test terminal blocks shall be provided for the same.

12.9 The Employer/ Owner shall have the right to carry out surprise inspections of the Metering Systems from time to time to check their accuracy.

12.10 The Contractor must comply with the relevant grid regulations, DISCOM's, State TRANSCO's & CEA's guidelines with respect to all the works corresponding to power evacuation, transmission, termination along with metering at DISCOM's substation.

13 Earthing

13.1 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
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	

13.2 General Requirements

13.2.1 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.

13.2.2 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.

13.2.3 Earth conductors shall be made of copper bonded steel or galvanized steel of sufficient cross section to carry the fault current and withstand corrosion.

13.2.4 Earth conductors buried in ground shall be laid minimum 600 mm below ground level unless otherwise indicated in the drawing. Back filling material to be placed over buried conductors shall be free from stones and harmful mixtures. Earthing conductor shall be buried at least 2000 mm outside the fence of electrical installations.

13.2.5 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.

13.2.6 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.

13.3 Earthing of PV array field

13.3.1 All PV Modules, Module Mounting Structures (MMS) and String Monitoring Unit (SMU) structures in the PV array field shall be bonded to the earthing system by two distinct connections.

13.3.2 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.

13.3.3 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.

13.3.4 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.

13.3.5 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.

13.3.6 SMU 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.

13.4 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.

13.5 Transformer Earthing

13.5.1 Inverter transformer neutral shall be floating, not to be earthed. Transformer tank, cable box, marshalling box and all other body earth points shall be earthed.

13.5.2 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.

13.5.3 Neutral and body of the auxiliary transformer shall be earthed.

13.6 Inverter Room and Main Control Room Earthing

13.6.1 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.

13.6.2 Cable racks and trays shall be connected to the earth grid at minimum two places using galvanized steel flat.

13.6.3 SCADA and other related electronic devices shall be earthed separately using minimum two no. of earth electrodes.

13.7 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.

13.8 Approval

13.8.1 Documents/ drawings

(i) Technical datasheet

(ii) Earthing Design calculation

13.9 Tests

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.

14 Lightning Protection System

14.1 Lightning Protection System (LPS) for entire plant against direct lighting strokes shall be provided as per IEC 62305:2010 or NFC 17-102:2011.

14.2 Protection Level for the entire plant shall be level – I.

14.3 LPS as per IEC 62305

Location of air terminals shall be designed as per rolling sphere method.

14.4 LPS as per NFC 17-102

Each ESE air terminal shall be provided with following accessories.

(i) Highly insulated poly-plastic adaptor to fix the ESE air terminal with the FRP mast

(ii) Fiberglass Reinforced Plastic (FRP) mast

(iii) Coupler to connect FRP mast with GI mast

(iv) Galvanized Iron mast with base plate and guy wire kit

(v) Down-conductor: PVC insulated flexible copper cable of suitable size complying with EN 50164-2 or equivalent standard. It shall be routed along the mast with suitable fixings and connecters

(vi) Test joint with each down conductor

(vii) Lightning event counter complying with EN 50164-6 or equivalent standard. It shall be fixed at suitable height in series with the down conductor.

(viii) Earth termination system in accordance with NFC 17-102. Earth electrodes shall comply with the EN 50164-2 or equivalent standard. Earth enhancing compounds complying with EN 50164-7 or equivalent standard, may be used where soil resistivity is higher and making it impossible to achieve system resistance within specified limit.

14.5 Accessories listed above are indicative only and any other fittings or accessories, which are usual or necessary for satisfactory operation of the lightning protection shall be provided by the Contractor without extra charges.

14.6 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.

14.7 The product shall be warranted for minimum of 2 (two) years against all material/ manufacturing defects and workmanship.

14.8 Type test reports as per IEC 62305:2010 or NFC 17-102:2011 shall be submitted during detailed engineering for approval.

15 Communication Cables

15.1 Optical Fibre Cables

15.1.1 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.

15.1.2 The cable shall have multiple single-mode or multimode fibres on as required basis so as to avoid the usage of any repeaters.

15.1.3 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.

15.1.4 The cable core shall have suitable characteristics and strengthening for prevention of damage during pulling.

15.1.5 All testing of the optic fiber cable being supplied shall be as per the relevant IEC, EIA and other international standards.

15.1.6 The Contractor shall ensure that minimum 100% cores are kept as spare in all types of optical fibre cables.

15.1.7 Cables shall be suitable for laying in conduits, ducts, trenches, racks and underground buried installation.

15.1.8 Spliced/ Repaired cables are not acceptable. Penetration of water resistance and impact

resistance shall be as per IEC standard.

15.2 Communication Cable (Modbus)

15.2.1 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.

15.2.2 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).

15.2.3 Communication cable shall be laid through underground with suitable HDPE ducts.

16 SCADA

16.1 General Requirements

16.1.1 The Contractor shall provide complete SCADA system with all accessories, auxiliaries and associated equipment and cables for the safe, efficient and reliable operation of entire solar plant and its auxiliary systems.

16.1.2 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.

16.1.3 SCADA System shall have the provision to perform the following functions.

(i) Real-time acquisition and display of data, status, alarms and trends.

(ii) Display of status of major equipment in Single Line Diagram (SLD) format with string level monitoring capability

(iii) Display and storage of measured values

(iv) Display and storage of derived/ calculated/ integrated values

(v) Generate, store and retrieve user configurable Sequence of Event (SOE) Reports

(vi) Remote monitoring of essential parameters on the web using standard modem (Internet connection for transferring data to web shall be taken by Contractor in the name of Employer for O&M period).

16.1.4 It shall be possible to remove/ replace redundant controller or various modules (like any I/O module, interface module, etc.) from its slot for maintenance purpose without switching off power supply to the corresponding rack without releasing any spurious signal to controller and causing disturbance or loss of controller functions for other controller.

16.1.5 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.

16.2 Programmable Logic based control system at Main Control Room

16.2.1 Bidder shall provide PLC based SCADA at Main Control Room. For other locations such as Inverter room, Sub Pooling Switchgear Room (if applicable) bidder may offer IO modules/ RTU/ PLC for completeness of SCADA.

16.2.2 PLC Processor

The processor unit shall be capable of executing the following functions.

(i) Receiving binary and analog signals from the field to server.

(ii) Implementing all logic functions for protection and annunciation of the equipment and systems.

(iii) Providing supervisory information for alarm, various types of displays, status information, trending, historical storage of data etc.

16.2.3 The SCADA shall be OPC version 2.05a compliant and implement an OPC- DA 2.05a server as per the specification of OPC Foundation. All data should be accessible through this OPC server. SCADA shall have OPC connectivity for other systems.

16.3 Human Machine Interface System (HMIS)

16.3.1 Graphical Interface Unit (GIU) / Operator work station (OWS) shall perform monitoring and operation of all devices interacting with PLC based system.

16.3.2 The system shall have built-in safety features that will allow/ disallow certain functions and entry fields within a function to be under password control to protect against inadvertent and unauthorized use of these functions. The system security shall contain various user levels with specific rights as finalized by the Employer during detailed engineering. However, no. of user levels, no. of users in a level and rights for each level shall be changeable by the programmer (Administrator).

16.3.3 Bidder has to provide suitable hardware and software-based firewall for network security to restrict unauthorized access to HMI/Solar SCADA PCs and system.

16.4 Programming Functionalities

Programming of the PLC Processor / controller as well as programming of HMIS shall be user friendly with graphical user interface. All programming functionalities shall be password protected to avoid unauthorized modification.

16.5 Software Requirements

16.5.1 All necessary software required for implementation of control logic, operator station displays / logs, storage & retrieval and other functional requirement shall be provided.

16.5.2 Industry standard operating system like WINDOWS (latest version) etc. to ensure openness and connectivity with other system in industry shall be provided. SCADA system shall support following standard protocols (included but not limited to) to communicate with

different sub system/Devices:

(i) Modbus (TCP/IP, RTU, ASCII)

(ii) Sub Station Protocol like IEC-61850

(iii) IEC 60870 – 5 – 101/ 104

(iv) Any other protocol on which the offered equipment (by Contractor) will communicate with SCADA.

16.5.3 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.

16.6 System Spare Capacity

16.6.1 Over and above the equipment and accessories required to meet the fully implemented system as per specification requirements, Control System shall have spare capacity of 10% along with the necessary hardware/equipment/accessories to meet the future expansion requirement.

16.7 Data Communication System (DCS)

The DCS shall have the following minimum features.

16.7.1 Redundant communication controllers shall be provided to handle the communication between I/O Modules (including remote I/O) and PLCs and between PLCs and operator work station.

16.7.2 The design shall be such as to minimize interruption of signals. It shall ensure that a single failure anywhere in the media shall cause no more than a single message to be disrupted and that message shall automatically be retransmitted. Any failure or physical removal of any station/module connected to the system bus shall not result in loss of any communication function to and from any other station/module.

16.7.3 Built-in diagnostics shall be provided for easy fault detection. Communication error detection and correction facility (ECC) shall be provided at all levels of communication. Failure of one bus and changeover to the standby system bus shall be automatic and completely bump less and the same shall be suitably alarmed/logged.

16.7.4 Data transmitting speed shall be sufficient to meet the responses of the system in terms of displays, control etc. plus 20% spare capacity shall be available for future expansion.

16.7.5 Contractor shall employ redundant Fiber optic backbone for data communication between Inverter rooms and main control room.

16.7.6 The Contractor shall furnish details regarding the communication system like communication protocol, bus utilization calculations etc.

16.8 Operator Interface Displays/Logs/Reports

Suitable Operator Interface Displays/Logs/Reports for control operation & monitoring shall be provided. The details shall be furnished and finalized during detailed engineering stage.

16.9 Historical Storage and Retrieval System (HSRS)

16.9.1 The HSRS shall collect, store and process system data from man-machine interface system and plant information system (MMIPIS) data base. The data shall be saved online on hard disk and automatically transferred to erasable long-term storage media once in every 24 hours periodically for long term storage. Provision shall be made to notify the operator when hard disk is certain percentage full. The disk capacity shall be sufficient to store at least seven days data.

16.9.2 The data to be stored in the above system shall include alarm and event list, periodic plant data, selected logs/reports. The data/information to be stored and frequency of storage and retrieval shall be finalised during detail engineering stage.

16.10 Control and Power Supply Scheme

Contractor shall provide the UPS/DC Power supply of suitable rating to cater all the load requirements of SCADA system and its auxiliaries. The power backup for the entire system should be at least for 02 hours.

16.11 Control Cabinets / Panels / Desks at Main Control Room

16.11.1 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.

16.11.2 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 supplier's standard practice for similar applications.

16.12 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.

16.13 Hardware at Main Control Room

16.13.1 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.

16.13.2 All the peripherals shall conform to the following minimum requirement but the exact make & model shall be as approved by Employer during detailed engineering. The LAN to be provided shall support TCP/IP protocol (Ethernet connectivity) with OPC RDI for interface

with PLCs/other systems and shall have data communication speed of min. 100 Mbps. All network components of LAN and Workstations shall be compatible to the LAN, without degrading its performance.

Processor	**64 Bit**
Hard disk	1 TB - RAID 1
Memory	8 GB RAM upgradable to 16 GB
Monitor	Min 22" LED Flat Monitor with non-interfaced refresh rate min. 75 Hz. Communication port-2 Serial bus, one parallel Dual 10/100/1000 Mbps. Ethernet Graphic Memory=16 MB Expansion slot=3
Screen display unit	Min 50" LED Flat Monitor with wall mounted arrangement for the display of SCADA screen
Removable bulk storage drive (DVD / DAT)	6 GB (minimum)
Removable Bulk Storage Media for above (with each server/ work-station)	10 nos.
DVD R/W	16x or higher
Intelligent UPS (on line) with remote monitoring for each workstation/ server	1 no. with 30 mins. Battery backup on machine load
Keyboard	ASCII
Pointing Device	Mouse
Colour Laser Printer	Heavy duty type with resolution of 600 dpi Resolution

16.14 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.

17 Illumination

17.1 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

17.2 General specification

17.2.1 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.

17.2.2 The Contractor shall furnish Guaranteed Technical Particulars of the LED luminaires, from renowned brands available in the market for approval of Employer.

17.2.3 Lighting system shall work on the auxiliary supply and same shall be incorporated in auxiliary loads. 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.

17.3 Lighting Levels

17.3.1 The average LUX level of 10 lm is to be maintained in switchyard. However, a lux level of 20 lm ((10+10) additional switchable on requirement only) is to be maintained in switchyard on transformer.

17.3.2 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:

Area	**LUX**
Control Room and equipment rooms	300
Office	300
Battery & other rooms	150
Internal/Periphery Roads	4
Transformer yard/Switchyard	20
H – pole and metering point	10

17.3.3 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.

17.4 LED Luminaire for Outdoor Applications

17.4.1 LED luminaires shall meet the following parameters:

Parameter	**Specified Value**
Input voltage	170-260 V
Input Frequency	50 Hz +/-1 Hz

Power Factor	0.95 (Minimum)
Power Efficiency	>96%
LED chip efficacy	>130 lumens per watt
Luminaire efficacy	>90 lumens per watt
Dispersion Angle	Minimum 120°
Total Harmonic Distortion	< 15 %
Working Temperature	-5° to +50° C
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	>75
Electrical Connector	Lead wire with 2 meter long – or as required by the customer at site.
Moisture protection in case of casing damage	IP 65 (driver unit shall preferably be totally encapsulated)

17.4.2 The LED luminaire (outdoor) housing, heat sink, pole mounting bracket, individual LED reflectors and front heat resistant tempered glass should be provided.

17.4.3 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.

17.4.4 The luminaire should be provided with in built power unit and electronic driver.

17.4.5 The luminaire should be suitable for both standard street light poles for side entry and bottom entry (post top).

17.4.6 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.

17.4.7 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.

17.4.8 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.

17.4.9 Junction box for lighting shall be made of fire retardant material. The degree of protection shall be IP55 for outdoor JB.

17.4.10 Lighting cables, wherever exposed to direct sunlight, shall be laid through Double Wall Corrugated (DWC) HDPE conduits.

17.5 LED Luminaire/Lamps for Indoor Applications

17.5.1 LED luminaire/lamps shall have minimum 3-star BEE rating.

17.5.2 All indoor LED luminaire/lamps shall be supplied with proper diffuser to avoid direct visibility of LED and suitable heat sink for longer life.

17.6 Warranty

All luminaires shall be warranted for minimum of 2 (two) years against all material/ manufacturing defects and workmanship.

17.7 Approval

17.7.1 Documents/ drawings

(i) Lux level calculations
(ii) Building and street lighting layout
(iii) Luminaire data sheet
(iv) Test certificates

18 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.

18.1 Pyranometer

18.1.1 The Contractor shall provide minimum 4 (four) number of secondary standard pyranometers (ISO 9060 classification) along with necessary accessories for measuring the incidental solar radiation at horizontal and inclined plane of array.

18.1.2 Specification of the pyranometer shall be as follows.

Parameter	**Specification**
Spectral Response	0.31 to 2.8 micron
Time response (95%)	Maximum 15s
Nonlinearity	±0.5%
Temperature Response	±2%
Tilt error	<±0.5%

Zero offset thermal radiation	±7 W/m^2
Zero offset temperature change	±2 W/m^2
Operating temperature range	0°C to +80°C
Non-stability	Maximum ±0.8%
Resolution	Minimum +/- 1W/m^2
Output	Analog output: 4 – 20 mA Serial output: RS485

18.1.3 Each instrument shall be supplied with necessary length of cables. Calibration certificate with calibration traceability to World Radiation Reference (WRR) or World Radiation Centre (WRC) shall be furnished along with the equipment. The Employer reserves the right to check the calibration at the expense of the Contractor. The signal cable length shall not exceed 20m. The Contractor shall provide instrument manual in hard and soft form.

18.2 Temperature Sensor

The Contractor shall provide minimum 6 (six) temperature sensors (1 (one) for ambient temperature measurement with shielding case and 5 (five) for module temperature measurement). 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.

18.3 Anemometer

Contractor shall provide one no. ultrasonic wind sensor (no moving parts) for wind speed and direction monitoring.

Details	**Values**
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^o (No dead band) with +/-2^o accuracy @12 m/s; Resolution: 1^o
Mounting Bracket	Anodized Aluminium bracket to reduce corrosion, all mounting bolts of SS
Protection Class	IP66
Output	RS232 and RS485

18.4 Data logger and Data Acquisition System

Data logger for the weather monitoring station should have the following features:

18.4.1 Provision for analog, digital and counter type inputs for interfacing with various type of sensors:

(i) Analog Input

- Adequate nos. for all analog sensors with redundancy
- Provision for operation in different current and voltage ranges as per connected sensors
- Accuracy of +/-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:

- Built-in GSM/ GPRS modem for wireless data transmission to SCADA/ cloud server (procurement of GPRS enabled SIM Card and connection subscription to be the responsibility of Contractor). It should be possible to remotely communicate with the device for configuration settings.
- RS485 MODBUS interface for data collection and storage on SCADA
- Web interface with provision for user login to enable viewing and downloading of weather data in XLS/ CSV format
- Communication protocol should support fast data transmission rates, enable operation in different Frequency bands and have an encryption-based data security layer for secure data transmission

(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: IP65

19 CCTV Camera

19.1 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 activities within Control Rooms

(iv) The Contractor has to propose the locations and number of cameras required for the Plant during bidding, however Employer's decision on number of cameras shall be final.

19.2 Monitoring stations of the CCTV Network shall be installed in Main Control Room.

19.3 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 video signals for viewing on monitors at control room and simultaneously record all video streams using latest compression techniques.

19.4 Camera shall be colour, suitable for day and night surveillance (even under complete darkness) and network compatible.

19.5 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.

19.6 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.

20 Fire Alarm System

20.1 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 2005	

20.2 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.

20.3 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 (CO_2 and dry powder type)
(iii) Microprocessor based fire alarm panel
(iv) Multi sensor smoke detectors
(v) Hooter cum strobe
(vi) Manual call points
(vii) Cables from sensor to fire Panel.

20.4 Minimum two numbers of fire extinguishers (CO_2 and Foam type each, of capacity 10 kg having BIS certification marking as per IS: 2171) shall be provided at every building/ encloser, transformer yard and switchyard. However, contractor must comply with existing building code for fire protection and relevant IS codes.

20.5 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.

20.6 Digital output from the fire detection system shall be integrated with SCADA.

20.7 Contractor shall submit the plan for fire and smoke detection system for the Employer's approval.

21 Testing Instruments

The Contractor shall provide the following set of instruments for on-site testing.

21.1 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)	
Three cable reels with cable length up to 20 m	
Carry Case-1 (capable of handling tester along with accessories)	

1 set of spare battery

21.2 Array tester

Parameter	**Specification**
Display	Backlit LCD or LED display
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	
1 set of spare battery	

21.3 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
Insulation Test Current	1 mA nominal
Auto Discharge	Discharge time< 0.5 Second for C = 1
Open Circuit test Voltage	>4 V, <8 V
Accessories	
Heavy duty Test Lead Set – 4 Nos.	
Carry Case with sufficient space for accommodating accessories.	

21.4 Digital Multimeter

Parameter	**Specification**
Display	Backlit LCD or LED display; Minimum resolution: 5 ¾ places for DC, 4 ¾ places for AC

Measuring Category	1000V CAT III as per IEC Standard 61010-1; wave shape independent RMS measurement (True RMS) suitable for operation in the site conditions.
Additional Functions	Resistance (Ω), Temperature (°C), Continuity, Diode, Capacitance, Frequency, Duty cycle measurement
Accessories	
Temperature Probe	
Silicon Test Lead	
Alligator Clip	
Carry Case with sufficient space for accommodating accessories.	

21.5 Clamp meter

Parameter	**Specification**
Display	Backlit LCD or LED display
Measuring Category	1000V CAT III as per IEC Standard 61010-1; wave shape independent RMS measurement (True RMS) suitable for operation in the site conditions.
Current Range	AC&DC Current up to 1000A/400 A
Voltage range	AC&DC Voltage upto 1000V
Additional Functions	Resistance, continuity, diode and non-contact voltage detection, Active, Reactive and Apparent Power, THD, PF
Accessories	
Test leads	
Battery	
Alligator Clip	
Carry Case with sufficient space for accommodating accessories.	

21.6 Infra-red thermal imaging camera

Parameter	**Specification**
Spectral response	8 µm to 14 µm (LW)
Temperature-sensitivity and calibration range	–20 °C to +120 °C
Atmospheric air temperature	-10 °C to +40 °C

Thermal sensitivity	NETD ≤ 0.1 K at 30 °C
Geometric resolution	640 x 480 pixels
Photo camera resolution	Approx. 30 times of IR camera resolution
Absolute error of measurement	< ± 2 K
Adjustable parameters	Emissivity, ambient 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 camera has to be traceably calibrated at least every two years. The calibration has to be documented. If the camera is not compliant, it has to be readjusted by the manufacturer.
Documentation	Storing of the infrared picture with the radiometric data

21.7 Digital lux meter

Parameter	**Specification**
Range	0 – 1000 lux
Accuracy	± (2% + 5)
Resolution	1 lux
Display	3½ digits, Backlit LCD/LED

21.8 All testing equipment shall possess valid calibration certificate issued from approved NABL labs.

21.9 Instruments of superior rating is allowed after seeking consent of the Employer.

21.10 Maintenance, calibration, up keeping, repair & replacement of these tools will be in the scope of the Contractor during 5 years of O&M.

21.11 It is Contractor's responsibility to arrange for tools, tackles, logistics, test kits, manpower, experts etc. required for trouble free operation of Plant.

22 Power Evacuation System

22.1 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 Employer.

22.2 The power evacuation system for the plant shall be as per the local DISCOM requirement and appropriate approval. The contractor shall get the route approval from the Employer or concerned authorities prior to start of the construction. Any changes in the route or scheme introduced by DISCOM at any point of the time prior to commissioning shall be complied without any additional cost to the Employer.

22.3 The ROW for the TL/UG cable shall be obtained prior to the construction of the line from the concerned authorities.

22.4 Overhead Transmission Line

In case the power evacuation is planned with overhead transmission line for plant internal and external evacuation, the design of tower and its accessories shall be as per the DISCOM's requirement and the design shall be submitted to Employer for approval/ accord.

22.5 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's requirement and the same shall be submitted to Employer for approval/ accord.

Civil, Mechanical & Plumbing Works

23 General Requirement

23.1 This section of Technical Specifications describes detailed technical and functional requirements of all civil, structural, mechanical & plumbing works included in the scope.

23.2 Standards & Codes

23.2.1 All design and construction of civil works shall conform to relevant Indian standards such as BIS, IRC, MORTH, NBC etc.

23.2.2 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.

23.2.3 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.

23.2.4 The design calculations for MMS, RCC structure, Steel structure, Foundation system, Road work, Drainage work, etc. shall be submitted for prior approval of Engineer before commencement of construction.

23.2.5 As per project requirements, the Employer may ask for approval of all civil designs and drawings by a Chartered Civil/ Structural Engineer.

23.3 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.

23.4 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.

24 Topographical Survey

24.1 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.

24.2 The Topographical survey shall be conducted at 20m x 20m grid, or as directed by the Engineer, with the help of digital surveying instruments like Total Station.

24.3 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.

24.4 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 these objects later on.

24.5 The survey work shall be carried out in UTM grid system. The contractor shall also establish the latitudes and longitudes 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.

24.6 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.

24.7 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.

25 Geotechnical Investigations

25.1 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.

25.2 The scope of work includes execution of complete soil exploration including boring and drilling, 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. 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.

25.3 The field investigations shall mainly include drilling of min. 5m deep boreholes (50% of total No. of boreholes shall be 10m deep), conducting SPT and collecting Disturbed (DS) and Undisturbed samples (UDS), conducting in-situ CBR test for approach road to the plant, internal roads & peripheral road; Trial pits (min 2mx2mx2.5m deep) and ERT s. Number and location of bore holes, CBR tests and Trial pits shall be decided as per the project layout, site topography and soil conditions in consultation with the Employer. There shall be minimum 1 nos. of Borehole per 5 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, 3 ERT and 3 CBR tests shall be taken per such block).

25.4 The proposed Geotechnical investigation plan indicating proposed locations of Trial pits, Boreholes, CBR test & ERT shall be submitted to the Employer for review and approval before start of work.

25.5 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 (UU), Undrained shear test, Consolidation tests, Unconfined compression tests, 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), 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.

25.6 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 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.

25.7 The report shall include the study for "Liquefaction potential assessment of the ground and suggestions for any ground improvement measures" as required.

25.8 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 M25 (M30 in coastal areas/ marshy soil) for all RCC works except liquid retaining structures like underground water tank etc. where minimum grade of concrete shall be M30 (M35 in coastal areas/ marshy soil). Cement higher than 43 Grade, shall not be used in construction.

25.9 In case the contractor wishes to adopt concrete pile foundation for MMS supports the Geo-tech. report shall also include the calculations for safe pile capacity under direct compression, lateral load and pull out. The report shall include recommendations about type of pile, its depth and dia. to be used.

25.10 In coastal areas and in marshy or swelling type soil, under reamed or driven precast concrete pile shall be used. In case contractor wishes to use helical piles the design, fabrication and installation shall conform to IBC (International building code).

25.11 The contractor shall carry out field trials for initial load test on pile to verify the pile design to confirm the safe load carrying capacity under direct compression, Lateral load and Pull out.

25.12 The nos. of piles to be tested under each category shall be finalized corresponding to geotechnical characteristics at site, plot area etc. However, minimum 5 nos. of piles shall be tested (min. 3 nos. in each block if the plant site is divided in discrete blocks separated from each other) under each category of load.

25.13 The locations of test piles shall be distributed over the plant site and to be finalized in consultation with Engineer. In case the MMS column is fixed using base plate-anchor bolt assembly, the adequacy of provided pile reinforcement in job (working) pile corresponding to the set of test loads shall be reviewed by the contractor for any additional requirement of reinforcement and the same shall be provided in the pile to be cast for initial load test.

25.14 In case the Contractor proposes to embed the Column leg in the pile for fixing, the test pile shall be provided with embedded column leg as per approved design and any dowels as required for application of test load. The drawing for the Test pile shall be submitted to Engineer for his approval before casting the test pile. The load test on pile shall be conducted after min. of 28 days from the date of casting. In case the contractor desires to conduct the test earlier than 28 days, he may use suitable higher grade concrete or if there is substantial evidence from earlier cube test results on design grade concrete to demonstrate the early gain of required compressive strength prior to application of the test load.

25.15 However, under no circumstances the test shall be conducted before 15 days of the date of casting the pile. All the dial gauges and hydraulic jack assembly shall be properly calibrated as per the requirements of relevant BIS standards and valid calibration certificate to this effect from Govt. / NABL accredited Test agency shall be submitted to the Engineer before use.

25.16 The contractor shall submit detailed methodology for conducting the tests in line with IS: 2911 (Part 4) for Engineer's approval before commencement of any test. After completion of these tests the contractor shall compile the test results and submit the report in a proper format as specified in the BIS standard with recommendations/ conclusions for Engineer's approval. The pile work shall start only after approval of the final pile design duly verified/ confirmed with initial load test results.

25.17 All buildings/ Open installations (MCR, ICR etc.), Switchyard and Sub-station area shall have levelled ground. No foundation for MMS, Buildings, Switch yard equipment & structures, Sub-stations, HT Line Towers, Transformer etc. shall rest on filled up ground. However, minor structures like cable trench, cable rack, pipe pedestal etc. may rest in filled up soil with max. safe bearing capacity for design consideration not more than 3 T/m^2.

26 Other Investigations

26.1 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.

26.2 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^o 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.

26.3 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 different grades of concrete to be used before start of work. The concrete mix shall be designed for each source of cement

and aggregates as per provisions of relevant BIS Standard. 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, he shall submit the Concrete mix design report from the RMC supplier for review and approval by the Engineer. (In case of RMC, reports for periodic cube tests from the supply batch shall also be submitted for review and record)

27 Area Grading and Land Development

27.1 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 all buildings/ open installations (ICR, MCR etc.), transformer yard and switch-yard shall be uniformly levelled at suitable RL to be finalized considering topography and HFL at site. The minimum plinth level of all buildings/ open installations shall be 450mm above FGL. Module mounting structure foundation/ Pile cap or any other pedestal shall be min. 200mm above FGL.

27.2 A detailed drawing for site levelling and grading (if necessary) shall be submitted by the contractor before commencement of grading and area development 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/ Module Layout drawing.

27.3 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.

27.4 It shall be ensured that the land is graded or levelled properly 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.

27.5 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.

28 Roads

28.1 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 access roads connecting MCR and other facilities/ buildings/ open installations like Local control room(s) (LCR)/ Inverter control room(s) (ICR), Sub-station & Switch yard (as applicable) etc. and Internal peripheral road along the boundary fence/ wall shall be provided for safe and easy transportation of men, material and equipment during construction and maintenance.

28.2 The Approach road connecting nearest public road and the Main gate shall be of 5m 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 shall be of 3.5m wide carriage way with 0.5m wide shoulders on either side while the peripheral road shall be of 2.5m wide carriage way with 0.5m 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 to avoid flow of storm water over the road. The roads shall be designed and constructed as per IRC SP-20 corresponding to design vehicular traffic (150 Commercial vehicles per day for approach and internal access roads & 45 Commercial vehicles per day for peripheral road) and critical field CBR value of the subgrade. Shoulder shall be of min. 150mm thickness.

28.3 However, following minimum road section details shall be followed:

Approach road from nearest existing Public road to Main Gate, Access road from Main Gate to MCR building and Internal roads connecting MCR building with LCR building and other facilities:

1) Topping: wearing course of 20 mm thick pre-mix carpet or surface dressing, compacted 75mm thick, with murrum blended with WBM Grade-III, as applicable.
2) WBM (CBR>100%): compacted 75mm thick, Grade III
3) WBM (CBR>100%): compacted 100 mm thick, Grade II

4) Granular sub-base (CBR>15%): compacted 200 mm thick in two layers of 100mm thickness each,
5) Compacted subgrade: top 300mm thick, compacted up to 98% of standard proctor density
6) Shoulders: compacted 150mm thick, murrum blended with WBM Grade-III

Peripheral Road:

1) Topping: surface dressing, compacted 75 mm thick, murrum blended with WBM Grade - III
2) WBM (CBR>100%): compacted 75 mm thick, Grade III
3) WBM (CBR>100%): compacted 75 mm thick, Grade II
4) Granular sub-base (CBR>15%): compacted 150 mm thick in two layers of 75mm thickness each,
5) Compacted subgrade: top 300mm thick, compacted up to 98% of standard proctor density
6) Shoulders: compacted 150mm thick, murrum blended with WBM Grade-III

28.4 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.

28.5 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.

28.6 The construction of road shall conform to relevant IRC/ MORTH standards.

28.7 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. Except for module cleaning system 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 suitable concrete (M20) bedding/ encasement shall be provided. Water supply pipe for module cleaning and service/ drinking water crossing the road shall be laid through Medium class GI steel pipe conforming to IS: 1161.

28.8 Minimum dia. of casing pipe to be used at road/ drain crossing for laying any facility like electric cable, water pipe line etc. shall be 150mm.

28.9 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, the same shall be levelled by laying & compacting murrum or any other suitable granular material so as to match 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.

28.10 The design and drawings for approach road, all internal roads and culverts shall be submitted to the Engineer for approval before execution.

29 Surface/ Area drainage

29.1 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.

29.2 The storm water drainage system shall be designed and planned to ensure no water stagnation in the plant.

29.3 The design shall conform to the provisions of IRC SP 42 and best Industry practices. (The design rainfall shall be taken as max. hourly rainfall at 25 years return period at project site as provided in the Isopluvial map of the relevant subzone annexed with Flood Estimation Reports of Central Water Commission (CWC).

29.4 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.

29.5 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.

29.6 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.

29.7 Suitable size plant peripheral drain as per design (min. bottom width x depth: 500mm x 500mm) 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 size of all internal and road side drains shall not be less than 450mm (bottom width) x 500mm (depth).

29.8 All trapezoidal drains shall be lined with either brick or RR masonry/ concrete or stone slabs as suitable to the site conditions. The min. Thickness of the lining shall be 115mm for brick masonry, 75mm for concrete slabs, 150mm for RR masonry and 100mm for stone slabs. The 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.

29.9 In case of rectangular drain, the thickness of the wall shall be checked against structural stability. Min. thickness shall be 230mm for brick wall, 300mm for RR masonry and 125mm for

RCC work, except for garland drain around buildings where the min. wall thickness can be 115mm, 200mm and 100mm respectively for brick masonry, RR masonry and RCC work.

29.10 The structural design of drains shall be as per provisions of relevant BIS standards and good industry practice.

29.11 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.

29.12 The proposed drainage scheme along with design calculations and drawings shall be submitted to the Engineer for review/ approval before start of construction.

29.13 The contractor shall also explore the possibility of providing rain water harvesting system for water conservation by constructing suitable collection wells along the drains or through provision of detention ponds etc. The scheme for rain water harvesting along with design calculations shall be submitted for approval.

30 Peripheral boundary Wall/Fence

30.1 The plant peripheral boundary shall be provided with either Chan link or barbed wire fencing or masonry boundary wall as specified.

30.2 The boundary fence/ wall 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/ wall shall be provided with Main entry gate. The fencing/ wall shall be with 2.5m height above grade level including 400mm dia. GI concertina wire at the top along with 3 no. of barbed wires on either arm to be fixed on Y shape angle brackets. The main gate shall be min. 5.5m wide (clear) (4 m carriage way + 1.5m wicket gate).

30.3 Chain link fencing

30.3.1 The fencing shall be of Chain link (GI or poly coat GI as applicable) mesh fabric with internal, corner and stay posts of RCC (min 200mm x 200mm size, M30 grade) or GI angle (min. ISA 75x75x6 mm), as applicable, along with 150mm height 230 thick brick/ 300 thick RR masonry toe wall, with 100mm thick PCC (1:3:6) foundation.

30.3.2 The brick masonry toe wall shall be plastered with 15thick CM (1:4) plaster on both faces and shall have min. 50 thick PCC (1:2:4) coping finished smooth and projecting 25mm on either side of the wall with top sloping inwards. The depth (below NGL) and width of toe wall foundation shall not be less than 450mm and 500mm respectively.

30.3.3 Spacing of intermediate posts shall not be more than 2.5m. Every 10^{th} intermediate post shall be provided with a stay post while every corner post shall be provided with two stay posts on either side.

30.3.4 Joints in RR masonry shall be properly raked and pointed with CM (1:3).

30.3.5 At pond or drain area suitable grid of MS solid SQ bar of min. Size 25 mm x 25 mm (spacing of vertical bars not more than 125mm) shall be provided in place of toe wall for smooth flow of water.

30.3.6 The GI chain link mesh fabric (40x40 mm with min. wire gauge 3.15mm, both ends twisted) and fencing shall conform to IS: 2721. Poly coat GI chain link mesh (50x50mm) shall conform to ASTM 668 and fencing shall conform to ASTM 567.

30.3.7 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.

30.3.8 All MS sections shall be painted with 2 coats of epoxy paint of approved make and shade over 2 coats of suitable primer.

30.4 Boundary wall

The boundary wall structure shall be a RCC beam-column structure with wall of either brick (min. 230mm thick), RR masonry (min. 300mm thick) concrete block (min. 200mm thick) or of Pre-cast RCC wall panels (min. 75mm thick). The top of the wall shall be provided with concrete coping (min. 50mm thick with 40mm projection on either side).

30.5 Barbed wire fencing

The details of barbed wire fencing shall be same as those for chain link fencing except providing barbed wires (4mm dia.) in place of chain-link mesh. The fence shall have 10 nos, of horizontal barbed wire lines and top 400mm height provided with 3 no. of barbed wire lines fixed to each arm of Y shaped angle supports welded to every angle post. Every 5th bay of the fence shall be provided with additional cross barbed diagonal wires.

30.6 Main Gate

30.6.1 The Main entry gate (2.5m height) shall of rugged design with solid MS steel sections (20x20mm). The spacing of vertical members shall not be more than 125 mm.

30.6.2 The gate shall be complete with MS flat guide track, castor wheel(s), GI fittings & fixtures like hinges, aldrop, locking arrangement, posts etc.

30.6.3 The main gate shall be of 2.5m height and shall have 4.5m wide Gate for vehicular movement and an adjacent 1.5m wide wicket gate for pedestrian movement.

30.6.4 The gate shall be provided with the Project name plate (2.5mx 1m, 3mm thick MS plate). The gate shall be painted with 2 coats of epoxy paint over 2 coats of suitable primer.

30.6.5 The gate shall be painted with 2 coats of epoxy paint of approved make and shade over 2 coats of suitable primer.

30.7 All design and drawings for peripheral boundary fence/ Wall and Main gate shall be submitted for Engineer's approval before execution.

31 Plant Layout

31.1 The contractor shall submit drawing showing proposed Project Plant and SPV module Layout.

31.2 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 Room/ cabin (s), all Buildings and Open installations with coordinates, Temporary Storage yard/ facility to be used by the contractor during construction, Contractor's & Engineer's site office, Proposed Array layout, Lightening arrester, UG/Over ground water Tank(s), Storm water drains, Corridor for buried cables etc.

31.3 The cable corridor shall be laid through clear gap between arrays and shall not be laid below modules for easy maintenance.

31.4 All the facilities and buildings shall be presented with suitable Legend.

31.5 The drawing shall be in suitable scale to have proper representation of the information.

31.6 The Plant & SPV module layout drawing shall be submitted by the contractor for review/ approval by the Engineer.

32 Design Loads

32.1 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.

32.2 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
a	Roof	1.50kN/ Sqm
b	Building floors (GF) & Grade Slab	10.00 kN/ Sqm
c	RCC Floors (General)	5.00 kN/ Sqm
d	Outdoor platforms, Stairs, Landing and Balconies, Walkway, Chequred plate & Grating (except cable trench cover)	5.00 kN/ Sqm
f	Road culverts & allied structures over drain & pipe crossings subjected to vehicular traffic	Design for Class – 'A' loading (Wheeled & Tracked both) as per IRC Standard
g	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 10kN

		/Sqm shall also be considered. The structure shall be designed for following criteria – (a) Inside empty with outside fill+ surcharge and water table at GL & (b) Inside water with no fill & water table outs side
h	Pre-cast and chequred plate cover ove cable trench	4.00 kN/ Sqm
i	a) Main access & Internal Roads b) Peripheral Road	(a) As per IRC SP 20 corresponding to vehicular traffic of 150 commercial vehicles per day and critical in-field CBR (b) As per IRC SP 20 corresponding to vehicular traffic of 45 commercial vehicles per day and critical in-field CBR

32.3 Primary Loads

1) Dead Load (DL)
2) Live Load (LL)
3) Snow Load (SnL)
4) Wind Load (WL) – Both along X & Z horizontal direction
5) Seismic Load (EL) – Both along X & Z horizontal direction

32.4 Basic wind speed (V_b) at project site shall be taken as per IS 875 (part-3) unless otherwise specified elsewhere.

32.5 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 K3 (topography factor) shall be considered as per IS 875 (Part-3) (However, minimum values for K_1, K_2 and K_3 shall be 1.0, 1.05 and 1.0 respectively)

32.6 In case of plant site within 60 km of sea coast, the importance factor for cyclonic region, 'k_4' shall be taken as 1.15. Provisions of IS: 15498 shall also be followed to ensure general safety of the structure.

32.7 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)

The Seismic Load shall be considered corresponding to Earth quake zone at site as per IS: 1893 (Part- 4) with Importance factor 1.5.

The Snow Load shall be considered as per IS:875 (Part-4).

Notes for WL on MMS:

WL shall be considered as detailed below for estimation of WL (±X, ±Z direction) under primary loads.

Load due to wind on side (exposed) face of respective MMS members (Drag force) for wind acting in (±) X & Z direction shall also be considered along with (i) & (ii) below.

1) Load due to fair (positive pressure) wind direction on design tilt angles of MMS members for wind acting in (±) X, Z direction
2) Load due to adverse (negative pressure) wind direction on design tilt angles of MMS members for wind acting in (±) X, Z direction

32.8 Design Load combinations

32.8.1 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

32.8.2 Following load combinations shall be considered in design:

1) DL+LL
2) DL+LL ± WLx
3) DL +LL± WLz
4) DL+LL ± ELx
5) DL+LL ± ELz
6) DL+SnL ± WLx
7) DL +SnL± WLz
8) DL+SnL ± ELx
9) DL+SnL ± ELz

32.8.3 All buildings, structures and foundations shall be designed to withstand loads corresponding to worst design load combination.

33 Foundations (General)

33.1 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. The depth of foundation (below NGL) shall not be less than 1m except in case of chain link fencing post (for boundary & transformer yard fencing) where it shall not be less than 750mm (below NGL).

33.2 Min. thickness of PCC below brick wall shall be 150mm.

33.3 All foundations of one 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

33.4 All design & drawings shall be submitted to the Engineer for approval before execution.

34 MMS Foundation

34.1 Module mounting structure (MMS) may be supported on isolated/ strip footing or pile foundation.

34.2 Bored cast-in situ, Driven precast or under reamed Concrete pile

34.2.1 In case the contractor proposes to provide concrete pile; the type, dia. and length of pile shall be as per recommendations of Geotechnical investigation report corresponding to prevalent soil characteristics at site. However, the min. dia. and depth of the pile shall be 300mm and 1800mm respectively except when very hard strata/ rock (N>100) is encountered at a higher level, the pile shall be extended in to the hard strata minimum 1.0 times the diameter of the pile with total depth of the pile not less than 1200mm below cut-off level.

34.2.2 As specified above, the MMS support shall project minimum 200mm above FGL (Finished grade level) to avoid any damage to the MMS column/sub support due to direct contact of rain water/ surface run-off. This shall be ensured through either single stage construction of entire pile length including portion above FGL or by providing a collar (to be cast in second stage) which shall project min. 75mm in plan beyond the pile face and shall extend min. 250mm below GL.

34.2.3 For proper bonding, the surface of first stage concrete shall be made rough by trowelling and cleaning out laitance and cement slurry by using wire brush on the surface of joint immediately after initial setting of concrete. The prepared surface should be clean watered to get saturated dry condition when fresh concrete is placed against it. The prepared surface shall be applied with a suitable bonding agent before construction of pile cap/ collar as required.

34.2.4 In case the column post/stub is supported through base plate-anchor bolt assembly, the same shall only be provided through RCC pile cap to be designed as per provisions of relevant BIS standard with min. clear overhang of 75mm. The pile shall embedded min. 50mm in the pile cap and the pile reinforcement shall be extended in to the pile cap for proper anchorage.

34.2.5 In case of collapse of foundation strata during drilling of the pile bore, removable steel liner shall be used to maintain design depth and diameter of the pile for proper concreting.

34.2.6 The design & installation of piles shall conform to IS: 2911.

34.2.7 The bore shall be free from water before poring of pile concrete. For under water concreting tremie shall be used.

34.3 Helical/ Screw Pile

34.3.1 The design, manufacture, testing and installation of Helical/ Screw pile shall conform to ICB-2009 and Practice Note 28- "**Screw Piles: Guidelines for Design, Construction & Installation,** ISSN 1176-0907 October 2015 (IPENZ Engineers New Zealand)"

34.3.2 The design of pile shall be undertaken and verified by a suitably qualified geotechnical or structural Chartered Engineer with experience in the design of helical/screw piles.

34.3.3 The pile shall be designed and manufactured in accordance with accepted engineering practice to resist all stresses induced by installation into the ground and service loads.

34.3.4 The steel grade for pile shaft, helix plates and other accessories shall be with min. Fy 350 MPa. Min. thickness (BMT) of shaft and helix plate shall be 6 and 8mm respectively in case of coastal installations and soils containing aggressive chemicals and at other project sites it shall be respectively 5 and 6mm. Cap plate and col base plate shall be min. 12mm thick and of min. grade E-250 conforming to IS:2062

34.3.5 All materials shall be hot dip galvanized conforming to relevant BIS standard with min. thickness of galvanization 80 microns.

34.3.6 Wherever the pile shaft is required to be infilled with concrete grout, the same shall be of min. grade M30 (anti shrink)

34.3.6.1 The allowable axial design load (Direct compression & Pull out), *Pa,* of helical piles shall be the **least of the following** values:

1) Sum of the areas of the helical bearing plates times the bearing capacity of the soil or rock comprising the bearing stratum.
2) Capacity determined from well-documented correlations with installation torque.
3) Load capacity determined from initial load tests.
4) Axial capacity of pile shaft.
5) Axial capacity of pile shaft couplings.
6) Sum of the axial capacity of helical bearing plates affixed to pile.

34.3.6.2 The lateral allowable load capacity of the pile shall be calculated using P-Y analysis and shall be verified with field trials. The allowable design lateral load shall be equal to the min. of (i) the total lateral load producing max. lateral deflection of 5mm and (ii) 50% of the total lateral load at which the lateral displacement increases to 12mm.

1) Dimensions of the central shaft and the number, size and thickness of helical bearing plates shall be sufficient to support the design loads.
2) The Design Report shall include following details:
   - Design loads
   - Geotechnical Strength Reduction Factors and supporting methodology
   - List of design standards

- Design methodology and how specific loads such as seismic, lateral and settlement are addressed
- Founding stratum
- Estimated length
- Connection design and details between pile shaft & pile cap plate and Col base plate
- Pre-production and production load testing to support design including acceptance criteria.

34.3.6.3 Helical piles shall be installed to specified embedment depth and torsional resistance criteria as per design. The torque applied during installation shall not exceed the maximum allowable installation torque of the helical pile

34.3.6.4 Special inspections shall be performed continuously during installation of helical pile foundations. The information recorded shall include installation equipment used, pile dimensions, tip elevations, final depth, final installation torque and other pertinent installation data as required.

34.3.6.5 The installation of piles shall be done by an agency having adequate experience in helical pile construction.

34.3.6.6 The method statement for pre-production load testing (initial test) and construction of Helical Pile shall be submitted for review and approval. The method statement shall comply following requirements:

34.3.6.6.1.1 Helical pile pre-production load testing

The Piling Contractor shall provide a method statement for the pre-production load testing. The method statement shall be submitted 2 weeks prior to pile installation for testing and shall contain the following information (as a minimum):

- Programme of the testing, detailing the timing and sequence of each load test including any additional investigations proposed
- The general arrangement of the equipment
- A method for measuring the displacement at the head and toe of each test pile
- Template for the Pile load test report
- Confirming the criteria for determining the acceptability of the compression, tension and lateral load tests
- A contingency plan in the event that a load test is deemed not acceptable
- A procedure for verifying the capacity for each individual pile, this may include correlating the installation torque for each pre-production pile with the load test results

- All pile load tests shall be supervised by suitably experienced personnel, who are competent to operate, monitor and record each test throughout its duration. Each pile load test shall be continuously monitored throughout its duration.

34.3.6.6.1.2 Helical Pile Construction

The contractor shall provide a method statement for each piling operation to be undertaken in executing the Works. The method statement shall describe all proposed equipment, and detail the construction sequence. The method statement shall be submitted with the tender and shall contain the following information (as a minimum):

- Programme of the works, detailing the timing and sequence of individual portions of the works
- Full details of the installation plant to be used, including manufacturer's information and proof of servicing/recent upkeep and calibration
- Proposed phasing of excavation/filling operations such that the design stresses in the piles (and any supporting frames) are not exceeded
- The contingency plan to be adopted, to minimize disruption and delay, in the event of encountering obstructions
- Anticipated noise levels (measured in dB) and vibration levels (measured in mm/sec) arising from piling operations (if applicable)

34.3.6.6.1.3 The Piling Contractor shall nominate a suitably experienced, professionally qualified engineer, as the "Piling Supervisor".

34.3.6.7 Unless specified else were, the field trials for initial load tests on concrete and helical/ screw pile shall conform to IS: 2911 (Part 4) & Practice Note-28 (IPENZ Engineers New Zealand) as applicable. The no. and location of such tests shall be as per the provisions stipulated under Cl. No. 26.8.

35.4 The Contractor shall also carry out routine tests on 0.5 % of the total no. of working/ job piles as per provisions of IS: 2911 (Part 4). In case of unsatisfactory results, min. no. of routine tests may be increased up to 2% of the total no. of working/ job piles as per the directions of the Engineer

35 Module Mounting Structure (MMS)

35.1 The module mounting structure design shall generally follow the existing land profile. The top of the table shall be in one plane.

35.2 In MMS analysis the column support shall be assumed at EGL/NGL

35.3 In case of topographical variations more than 3^{o}, the contractor shall carry out detailed study of its effect on array layout, shadow analysis and structural stability of MMS.

35.4 The structure shall be designed to allow easy replacement of any module and shall be in line with site requirements.

35.5 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.

35.6 The contractor can also propose new light gauge structural steel or structural aluminum sections other than specified in IS: 811 subject to approval of the Engineer. In this 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.

35.7 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 & other members – 2.0mm

35.8 The primary loads and load combinations for design of MMS structure shall be as specified under Cl. No. 33. The design shall be done by Working stress method and no increase in allowable stress shall be permitted.

35.9 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

35.10 In case of natural frequency in first mode less than 1 Hz, the design of the MMS structure shall also be checked against dynamic effects of wind as per provisions of IS – 875 (Part-3) using gust factor method.

35.11 The purlins shall be provided with following min. 10mm dia. GI sag/ tie rods or 30x30x2 GI tie angles:

- 1 no. tie rod in middle of each span
- 1 no. diagonal tie rod at each corner in end spans

35.12 Lateral restraint to compression flange if any due to PV panels is not permitted in purlin design.

35.13 The vertical diagonal bracing shall be provided in alternate spans of each unit (table) of MMS.

35.14 MMS shall support SPV modules at a given orientation & tilt and shall absorb and transfer the mechanical loads to the ground properly.

35.15 Welding of structure at site shall not be allowed and only bolted connections shall be used.

35.16 The MMS structure 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.

35.17 It is to ensure 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 interfer with the coating process.

35.18 The bidder shall ensure that inner side is also provided with galvanization coating.

35.19 The galvanization shall be done after fabrication of members and cutting of holes to ensure galvanization of all cut/ exposed edges.

35.20 In case the proposed section is made up of Aluminum, anodized coating shall be Gr. AC25 and shall conform to IS: 1868.

35.21 The array structure shall be so designed that it will occupy minimum space without sacrificing the output from SPV panels at the same time.

35.22 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.

35.23 Fasteners and washers to be used for erection of mounting structures and those for fixing Module over MMS shall be of stainless steel grade SS 304 & SS 316 with property class A-70 conforming to relevant ISO standard and must sustain the adverse climatic conditions to ensure the life of the structure for 25 years.

35.24 Min. diameter of bolt for MMS connections shall be 10mm except for column-rafter connection where it shall not be less than 12mm (not less than 16mm with bushing in case of single bolt connection for seasonal tilt).

35.25 Modules shall be clamped & bolted with the structure properly. The material of clamps shall be Al / SS – 316 having weather resistant properties. Clamp/ bolt shall use EPDM rubber and shall be designed in such a way so as not to cast any shadow on the active part of a module.

35.26 MMS column post supported with base plate secured to foundation shall be fixed with galvanized high strength “J” bolts conforming to specifications of IS: 4000/ IS: 1367 and relevant IS code Installation of foundation bolts and embedment of column leg in foundation concrete shall be done by using template to ensure proper alignment. The underside of base plate shall be provided with anti- shrink grout.

35.27 In case the contractor proposes to extend the column leg to embed it in the pile as an alternate fixing arrangement, the column member shall be extended for full depth of the pile (100mm cover at tip of the pile) with an end plate of min. 4mm thickness to be fixed at the bottom of column leg. (However, for plants in coastal area or in case of marshy soil the column post shall be supported only with base secured to foundation through base plate and anchor bolt assembly and no embedment of column leg in foundation is permitted)

35.28 The area of c/s of embedded leg shall not be less than 0.8% of pile cross sectional area.

35.29 The array structure shall be grounded properly using maintenance free earthing kit.

35.30 The bidder/manufacturer shall specify installation details of the PV modules and the support structures with appropriate diagram and drawings.

35.31 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

35.32 The length of one unit (Table) of MMS shall not generally be more than 20m.

35.33 The contractor shall submit the detailed design calculations and drawings for MMS structure, bill of materials and their specifications/ standards to the Engineer for approval before start of fabrication work.

36 Concrete Works

36.1 Construction of all RCC works shall be done with approved design mix as per IS 456 and the materials used viz. Cement, coarse & fine aggregate, Reinforcement steel etc. shall conform to relevant BIS standards.

36.2 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).

36.3 Reinforcement steel shall be of high strength TMT bars of grade Fe500 D conforming to IS: 1786. Ductile detailing in accordance with IS: 13920 shall be adopted for superstructure and sub-structure of all RCC buildings and structures.

36.4 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/ mm2 at 28 days.

37 Miscellaneous Steel Works

37.1 Unless otherwise specified elsewhere, all structural steel work shall be designed as per provisions of IS: 800 with working stress method of design (WSD).

37.2 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.

38 Buildings

38.1 General Requirement

38.1.1 Plant buildings/ open installations are required to be constructed for housing the electrical equipment/ panel (Local Control Room Building - LCR) 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 & Security cabin(s) (at strategic locations) shall also be provided to secure the plant from any theft/ burglary/unauthorized entry.

38.1.2 Unless otherwise specified elsewhere, all buildings except Security room/ cabin shall have RCC framed structure. Brick partition walls shall be provided for Kitchen, Pantry, Battery room and Toilet units. For other rooms AL Glass partitions shall be provided. The equipment area shall be designed with OEM requirements to ensure all satisfactory operations. The security room/ cabin(s) shall be of prefabricated structure.

38.1.3 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)

38.1.4 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. Horizontal/ vertical bands through projections/ groves in external plaster may be provided to break the monotony. Roof slab shall have projection of 450mm beyond external walls with RCC parapet wall of 450 mm clear height all-around which shall form a projected band at roof level. For weather protection all doors and windows shall be provided with 450mm wide RCC chajja. However, chajja for rolling shutter shall be 750mm wide.

38.2 Functional requirements

38.2.1 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 (min. carpet area 12m^2) & Conference room (min. carpet area 20 m^2)
- Inverter/ Switchgear, equipment room(s) as per OEM requirements
- Supervisor cabin and office area (min. carpet area 20 m^2)
- Store cum record room (min. carpet area 15 m^2)
- Battery room as per requirement

- Toilet block with separate gents and ladies wash room facilities (min. total carpet area 12 m^2)
- Pantry with service platform and utensil washing facilities (min. carpet area 5 m^2)
- Suitable provision for passage (for smooth movement of O & M personnel), cable trenches, operating area etc. (min. clear width 1500mm)

38.2.2 LCR/ Inverter Building

- Unless otherwise specified elsewhere, Inverter room/ LCR consists of data loggers, battery, Inverter, Electrical panels etc. as per requirement. There shall be suitable provision for easy/ smooth passage for O & M personnel, cable trench, operating area etc.
- The size of LCR/ Inverter room shall be provided as per OEM requirements. However, min. clear height up to soffit of beam shall be 4m.
- In case ICR and MCR building facilities are clubbed in one single building, the Equipment area and Office cum Control room area shall be separated by 230mm thick brick wall with provision of internal Fire-Resistant entry door. Equipment area shall have one exit door excluding rolling shutter.
- MCR building shall have separate main entry to office area.

38.2.3 Security Room/ Cabin

38.2.3.1 Contractor shall provide required number of security cabins at strategic locations & at corners of the plot and 1 nos. security room at Main entry gate.

38.2.3.2 The Security room shall be of min. size 4m x 4m x 2.75m height The Security cabin shall be of min. size 1.2 x 1.8m x 2.5m height.

38.2.3.3 Security room/ cabin 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/ cum and adequate thickness. Roof shall be provided with suitable slope, not less than 10^0 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.

38.2.3.4 The Main 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. Security cabin shall have one AL glazed door (0.75m widex2.1m height) and 1 no. AL sliding window (0.8m width x 1.0 m height) with AL (anodized) grill on one side. All glazing shall be of clear float glass with thickness of 4mm

for window and 6 mm for door panel.

38.2.3.5 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.

38.2.3.6 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.

38.2.3.7 Anchor/ foundation bolts shall conform to IS: 5624 and IS 800.

38.2.3.8 The Security Cabin may be installed on concrete M15 skid platform (min. 350 thick) with skin reinforcement shrinkage or shall be supported on RCC pedestal & foundations. The concrete platform shall project 200mm beyond the walls.

38.2.3.9 The Security Room shall be supported on RCC pedestal & foundations.

38.2.3.10 The Design and drawings shall be submitted for approval prior to fabrication and installation.

39 Flooring, Skirting and Dado

39.1 Store area, Equipment Room

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.

39.2 SCADA Room, Control cum Office Room, Supervisor Room and Lobby

40 mm thick Heavy duty vitrified tile (8mm thick) flooring with matching skirting of 100mm height.

39.3 Battery Room

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 thk) flooring and dado shall be provided

39.4 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.

39.5 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

39.6 Passage/ Corridor

40 mm thick Heavy duty vitrified tile (8mm thick) flooring with matching skirting of 100mm height.

39.7 Steps

Kota stone (20 thick) or 50 thick cement concrete (IPS) flooring conforming to IS 2571

39.8 All items shall be of reputed make. Only Items with approved samples by the Engineer shall be used.

40 Doors and Windows

40.1 Doors, windows, louvers and ventilators shall be made of AL sections (minimum average thickness 2.5mm), industrial grade, anodized (grade AC25, min. thickness 25 micron conforming to IS: 1868) or with polyester powder coating (Total DFT 50 microns conforming to IS: 13871) and shall be of approved make & colour shade. All sections, fittings and fixtures shall be anodized (min. thickness of coating 20 micron). The window and door shutters shall be of clear float/ wired/ ground glass as per design/ functional requirements. The doors in toile area shall be of steel frame with solid core (MDF) flush shutter, 35mm thick, with laminated finish on both sides conforming to IS: 2202.

40.2 AL Louvers, duct/ ventilation openings shall be provided as per functional requirement.

40.3 All doors, windows and ventilators shall be provided with all necessary fittings and fixtures like handles, tower bolts, wind stays, hinges etc. of heavy duty anodized AL. All doors shall be provided with hydraulic door closure of required capacity.

40.4 All windows shall be provided with suitable AL grill of anodized sections with adequate thickness for security purposes.

40.5 Clear float glass for window and door shutter shall be of min 4mm and 6mm thickness respectively. Wired/ ground glass where provided shall be of min thickness 6mm.

40.6 Entrance door and door in passage shall be min. 1.5m wide (double leaf) x 2.1 m height while door for Conference room and Store room shall be min. 1.2m wide x 2.1m height. All other doors shall be min. 1.0m widex2.1m height except for WC which may be of 0.8m width.

40.7 Rolling shutters shall be of required size and shall be made of cold rolled steel strips with adequate gauge thickness (min. 18 gauge) and shall conform to IS 6248. Rolling shutter shall be provided with all fixture, accessories, paintings etc. all complete and shall be mechanically operated type.

41 Roofing

41.1 The roof of all RCC buildings shall be provided with min. slope of 1:100 for effective drainage of rain water. The slope shall be achieved either by application of screed concrete of grade 1:2:4 (with 12.5mm down coarse aggregate) with min. 25mm thick CM 1:4 layer on top to achieve smooth surface to facilitate application of water proofing treatment.

41.2 The water proofing treatment shall be in situ five course water proofing treatment with APP (Atactic Polypropylene) modified Polymeric membrane over roof consisting of first coat of bitumen primer @ 0.40Kg per sqm, 2nd & 4th courses of bonding material @ 1.20 kg/sqm,

which shall consist of blown type bitumen of grade 85/25 conforming to IS : 702, 3rd layer of roofing membrane APP modified Polymeric membrane 2.0 mm thick of 3.00 Kg/sqm weight consisting of five layers prefabricated with centre core as 100 micron HMHDPE film sandwiched on both sides with polymeric mix and the polymeric mix is protected on both sides with 20 micron HMHDPE film. The top most layer (5th layer) shall be finished with brick tiles of class designation 10 grouted with cement mortar 1:3 (1 cement: 3 fine sand) mixed with 2% integral water proofing compound by weight of cement over a 12 mm layer of cement mortar 1:3 (1 cement: 3 fine sand) and finished neat. The water proofing treatment shall be extended over golla/ fillet and inner face of the parapet up to 450mm height.

41.3 The corners at parapet wall and slab shall be provided with 50 thick fillet/ golla in CM 1:3 with neat finish.

41.4 Required no. of rain water down take pipes min. 100mm dia. PVC pipes (UV resistant), with 450x450mmx15mm deep khurra and MS grill at inlet shall be provided for rain water disposal.

42 Plinth protection and drain

42.1 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.

42.2 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

43 Plinth filling for buildings

43.1 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 bounder 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)

44 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.

45 Plumbing & Sanitary Works

45.1 Toilet block (with separate wash room facilities for both Genders) in MCR building

45.2 Wash rooms 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
- Soap holder and liquid soap dispenser
- Ventilators – Mechanical exhaust facility of adequate capacity
- Overhead PVC water storage tank – Capacity 1000 litres (common for both wash rooms)

45.3 Pantry room shall be provided with kitchen sink cum drain board and provision for installation of Water Cooler.

45.4 One toilet room with provision of WC and Wash basin shall be provided at Security Room near main gate.

45.5 Necessary plumbing lines for MCR building and Security Room near main gate.

45.6 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.

46 Painting & Other Finishes

46.1 Painting

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 Walls except toilets battery room	Acrylic emulsion (for MCR) & Oil bound distemper (for LC Security Room)
Battery room	Acid/ Alkali resistant tiled dado of 2100 mm height & Acid resista resin-based epoxy paint above dado (Vitrified tile flooring and dado with oil bound distemper in case of maintenan free batteries)
Toilet	Oil bound distemper
External Walls	All weather proof cement based acrylic emulsion paint, exteri grade
MMS foundations/ Earth	Cement paint

pit Enclosure	
Underside of roof slab	White wash
Air-conditioned areas	Underside of roof slab- Under deck insulation with 50mm thi mineral wool, min. density 45 kg/ m3 and Gypsum board fals ceiling with GI grid/ Gypsum tile (600x600mmx12 thick) fals ceiling with AL grid as per manufacturer's details
Structural steel work	2 coats of synthetic enamel paint over 2 coats of suitable primer

47 Air conditioning & Ventilation for MCR and Other Buildings

47.1 All buildings shall be equipped with appropriate numbers of fans for effective heat dissipation.

47.2 In MCR building, the supervisor room, Conference room and SCADA room shall have split type air conditioning units.

48 Fire Extinguishers

48.1 All buildings shall be installed with required no. of fire extinguishers as per relevant BIS standard and NBC. LiquefiedCO_2/ foam/ ABC type fire extinguisher shall be upright type of capacity 10kg conforming to IS: 2171, IS: 10658.

48.2 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.

49 Sand buckets

49.1 Sand buckets shall be wall mounted made from at least 24SWG sheet with bracket fixing on wall conforming to IS: 2546.

49.2 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.

50 Sign Boards and Danger Boards

50.1 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

50.2 The Signboard shall be made of steel plate of not less than 3 mm. Letters on the board shall be with appropriate illumination arrangements.

50.3 Safety signs, building evacuation plan and direction signs, assembly points shall also be placed at strategic locations.

50.4 The Contractor shall provide to the Engineer, detailed specifications of the sign boards.

51 Masonry Work

51.1 The masonry work shall be of bricks, laterite blocks (as per site conditions) or concrete blocks.

51.2 All external walls of buildings shall be 230mm and internal walls shall be 230mm or 115mm as per requirements.

51.3 All concrete block masonry walls shall be min. 200mm thick.

51.4 Brick work shall be in cement mortar (CM) 1:6 & 1:4 for 230 mm and 115 mm thick brick wall respectively unless specified.

51.5 Unless otherwise specified elsewhere, Bricks shall be of class designation 7.5 conforming to IS: 1077, IS: 2212 & IS: 3495.

51.6 All concrete blocks shall be of min. compressive strength of 7.5 N/mm2 and shall be of Grade-A conforming to IS: 2185.

51.7 The laterite blocks shall conform to IS: 3620.

51.8 All buildings shall be provided with suitable damp-proof course (DPC). The DPC shall be with PCC (1:2:4) using 6 down coarse aggregate and water proofing admixture. The min. thickness of DPC shall be 40mm.

51.9 The construction of brick masonry shall conform to IS: 2212. Construction of Concrete block masonry shall conform to IS: 2572.

52 Plastering, Pointing & Coping Works

52.1 All brick masonry work shall be provided with plaster.

52.2 Wall and ceiling plaster shall be in cement mortar (CM) 1:6 and 1:3 respectively.

52.3 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.

52.4 All joints in stone masonry shall be raked and pointed in cement mortar (CM) 1:3 except specified otherwise.

52.5 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.

52.6 All door and window chajja shall be provided with 10mm wide drip course.

53 Building Water Supply & Plumbing Works

53.1 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.

53.2 Rain water pipe shall be of PVC conforming to relevant BIS standard.

53.3 All sewerage, waste water and ventilation pipes shall be of HDPE conforming to relevant BIS standard.

53.4 MCR building and Security room shall be connected to Sewage treatment facility including all associated works like Manholes etc.

53.5 Sewage Treatment facility

53.5.1 The Contractor shall design & provide soak pit and RCC Septic tank for treatment of sewage and waste water from MCR building and Security room. The septic shall be designed as liquid retaining structure conforming to IS:3370 for design loads as specified under Cl. No. 57. However, in case of ground water within 1.5m of finished grade level or the soil strata being of low permeability (permeability ≤ 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.

53.5.2 The design and drawings shall be submitted for approval prior to execution.

54 Pipe & Cable Trenches

54.1 All trenches inside the building and transformer area shall be of RCC. The min. wall and base slab thickness shall be 100mm for depth ≤ 850mm and 150mm for depths > 850mm.

54.2 The trench shall be designed for lateral load due to external soil fill, ground water table at FGL and 5.0 KN/ Sqm surcharge. 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.

54.3 Internal trenches (inside buildings) shall be provided with chequred plate (min. 8mm thick with angle stiffeners as required) covers while external trench shall have precast concrete covers.

54.4 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.

54.5 The trench cover (chequered or pre – cast both) shall be provided with suitable lifting hooks.

54.6 As required suitable MS insert plates shall be provided on trench wall to support the cable rack/ pipe.

54.7 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.

54.8 The external buried cables shall be laid in excavated trench as specified under specifications for Electrical works. The sand for filling shall be of Grade – IV conforming to IS: 383.

55 Transformer Yard Civil Works

55.1 Transformer and equipment foundations shall be founded on piles/isolated spread footings or block foundation depending on the final geotechnical investigation report and functional requirements.

55.2 In case of transformer oil tank capacity ≥ 2000 litres, the transformer 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 min. 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 250 mm free space above gravel fill. The bottom floor of the soak shall have steep slope with a sump pit {not less than 1(v): 5 (h)} for quick drainage of and removal of oil in case of spillage.

55.3 In case of transformer oil tank capacity more ≥ 25000 litres, the soak pit shall be connected to a separate burnt oil pit through discharge pipe and shall be suitably sized to accommodate full oil volume (excluding free board above inlet pipe) of the transformer connected to it, without backflow. In this case the capacity of the soak pit may be reduced to min. 1/3rd 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.

55.4 Both, the transformer soak including side walls and burnt oil pit shall be of RCC. 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.

55.5 The area around the transformer and equipment shall be covered with uniformly graded granite stone gravel of size 40mm.

55.6 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 50x50x6)

55.7 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.

55.8 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.

55.9 The transformer yard fencing work shall conform to CEIG requirements.

55.10 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.

56 Water Supply & Cleaning of Modules

56.1 The contractor shall design and install the effective module cleaning system.

56.2 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.

56.3 The Contractor shall design the system for cleaning the photovoltaic modules at least once in two weeks 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 litre / Sqm of surface area of SPV module for washing shall be considered in estimation of required quantity of water storage for module cleaning.

56.4 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.

56.5 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.

56.6 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.

56.7 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.

56.8 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.

56.9 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.

56.10 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 50kg/cm2 (5 MPa)

56.11 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.

57 Underground Water Tank

57.1 The top of the UG tank shall be 250 mm above FGL.

57.2 The tank shall have clear free board of 300mm above MWL.

57.3 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 opening for edge protection. Rungs shall be painted with 2 coats of epoxy paint over 2 coats of primer.

57.4 The underground RCC tank shall be designed for following load conditions:

- External earth pressure + hydrostatic pressure due to ground water table (to be considered at FGL for design purposes) + Surcharge of 20 kN/ Sqm and Tank Empty.
- Tank full up to MWL and no external loads

57.5 The design 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 M30 (M35 in coastal areas, marshy and saturated soils) 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.

57.6 The underground 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

58 Transmission Line Structures

56.1 Galvanized 220 kV and 132 kV Transmission Line towers, Tower extensions & accessories and 11 kV, 22kV & 33 kV transmission poles, towers & accessories shall be designed following latest guidelines of respective SEB (State electricity board)/ STU (State transmission utility) and got 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.

56.2 Approved copies of these designs & drawings shall be submitted to the employer for reference and record.

59 Miscellaneous Structures

59.1 Support structure for weather monitoring device

59.1.1 Weather monitoring device shall be mounted on tubular steel pole of required height. The pole shall conform to IS: 2713.

59.1.2 The pole shall be secured to an independent RCC foundation structure through Base plate and Anchor bolt assembly.

59.1.3 200 long 20 dia. rods shall be welded to the pole at 300 mm C/c for access to the device for maintenance purpose.

59.1.4 The support structure shall be hot dip galvanized.

59.2 Support structures for SMU

59.2.1 SMU shall not be supported from MMS and shall have an independent structural steel supporting frame of ISMC 75, secured to an independent RCC foundation structure.

59.2.2 The support structure shall be of adequate height to ensure either min. ground clearance of 1.2m to SMU unit or HFL + 100mm, whichever is higher.

59.3 LA Mast & foundation

59.3.1 The LA mast shall be a self-supporting structure with GI tubular pole of required height. The pole shall confirm to IS: 2713.

59.3.2 The pole shall be secured to an independent RCC foundation structure through Base late & Anchor bolt assembly.

Quality Assurance and Inspection of Civil & Structural Works

60 Introduction

60.1 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.

60.2 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.

60.3 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.

60.4 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.

60.5 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.

60.6 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

61 QA and QC Manpower

61.1 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.

61.2 All correspondence related to Quality Assurance shall be addressed by the contractor's QA coordinator to the Engineer.

61.3 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.

61.4 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.

61.5 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.

62 Laboratory and Field Testing

62.1 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.

62.2 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.

62.3 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.

62.4 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.

62.5 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.

62.6 In case contractor desires to hire the services of any established laboratory nearby for 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.

62.7 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.

62.8 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.

62.9 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.

63 Sampling and Testing of Construction Materials

63.1 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.

63.2 All samples shall be jointly drawn, signed and sealed wherever required, by the contractor and the engineer or his authorized representative.

63.3 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.

63.4 All testing shall be done in the presence of Engineer or his authorized representative in a NABL accredited / Govt. Laboratory acceptable to Engineer.

63.5 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.

63.6 The test report along with the recommendations shall be obtained from the laboratory without delay and submitted to Engineer.

64 Purchase and Service

64.1 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.

64.2 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.

64.3 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.

64.4 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.

65 Field Quality Plan

65.1 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.

65.2 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.

65.3 An Indicative Field & Manufacturing Quality Plan for civil, structural and MMS works is enclosed with this specification for reference as Annexure-C.

66 General QA Requirements

66.1 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 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

66.2 Notes:

66.2.1 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.

66.2.2 All test reports/ inspection reports shall be submitted in soft copy also and shall be available at site for easy access to the Engineer.

66.2.3 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.

Performance Measurement Procedure

67 Performance Ratio (PR)

Performance Ratio (PR) test for Operational Acceptance of the plant shall be performed as per the procedure attached in Annexure-D.

68 Capacity Utilization Factor (CUF)

Capacity Utilization Factor of the plant shall be calculated as pe the procedure attached in Annexure-D.

Battery Energy Storage System

69 Scope of Works

The Scope of Work covered under this specification shall be but not limited to the following.

69.1 Initial Design and Fabrication

For the initial design and fabrication of the equipment, the Contractor shall

- Design, fabricate, and assemble a fully functional, transportable BESS that meets the requirements delineated herein. This shall include a control system that provides standard input/output channels and appropriate control actions for all required operational and protective features.
- Fully document the design and expected performance of the BESS by means of documents, drawings, reports, data, and other submittals, as required herein.
- Perform factory acceptance testing of the BESS.
- Conduct design review meetings during initial design and fabrication, in Consultation with the Employer with special reference to the geographical/climatic conditions of the Project site.
- Obtain site-specific data in preparation for developing installation implementation plans.
- Develop site installation/construction drawings, specifications, and calculations.
- Supply any special equipment and tools required for maintenance of the BESS.
- Supply an initial complement of spare parts (at a to-be-determined level).
- Provide warranty for the entire BESS and its constituent equipment.

69.2 Transportation and Site Setup

Interconnection of the BESS with the grid is at the point of common connection (PCC). The Contractor shall be responsible for all equipment and installation activities up to the system side of the PCC. The Contractor will be responsible for completing the necessary work for interconnection point.

N.B. Trucks/carriers no longer than 20ft long may be feasible for transport of material.

69.3 Installation/Interconnection

For installation/interconnection, the Contractor shall

- Develop drawings, specifications, and calculations for Contractor's scope of installation equipment and services (that is, up to the BESS side of the PCC).
- Develop detailed start-up and site acceptance test (SAT) plans.
- Obtain all permits necessary to transport the BESS to the site.
- Ship the BESS to the project site.
- Assemble BESS components on site to produce a functional system (as required).
- Perform start-up testing and SAT of the BESS.
- Provide on-site Contractor representative during installation and/or interconnection activities by the Employer and during start-up and SAT of the BESS by Contractor.
- Obtain permits necessary to prepare the site and to install and interconnect the BESS to the grid.
- Provide a complete set of as-built drawings.
- Provide a training class for the Employer's technicians and maintenance personnel.

69.4 Operation and Maintenance

Employer intends to entrust the operation and maintenance (O&M) of the BESS on comprehensive basis to the Contractor on turnkey for the 5 (Five) years. The rates quoted by bidder for Comprehensive O&M of the Plant Facilities on yearly basis for 5 years shall be inclusive of the replacement costs if any.

69.5 Definitions

- **PCC** – Point of common connection, the electrical boundary between the Solar PV Power Plant and the electrical network.
- **Host Utility** – Himachal Pradesh State Electricity Board Limited (HPSEBL)
- **Unit battery** – A unit battery is the minimum field-replaceable stored energy component or assembly. It may consist of one or more electrochemical cells, electrically interconnected in any series and/or series–parallel configuration. A unit battery has one (and not more than one) set of positive and negative terminals, by which it is interconnected with the rest of the storage system.
- **FAT** – Factory Acceptance Test
- **BESS** – Transportable, containerized energy storage system based on commercially available electrochemical storage solutions, capable of receiving, storing and delivering electrical energy at specified rate(s) suitable for the application laid out in the specifications herein. It comprises of unit batteries, battery management system

(BMS), auxiliaries, such as HVAC and fire suppression systems, step-up transformers to match utility grid, ac switchgear, Control Systems etc.

- **BMS** - or Battery Management System, is any electronic system that manages a rechargeable battery (cell or battery pack), including protecting the battery from operating outside its Safe Operating Area, monitoring its state, calculating secondary data, reporting that data, controlling its environment, authenticating it and / or balancing it.

70 Site-Specific Implementation Requirements

70.1 Procurement-Specific Location and Site Characteristics for Design

Table-1 below lists supply-specific location and site characteristics.

Table 1: Procurement-Specific Location and Site Characteristics

Item	**Characteristic**
Location	Rangreek, Near Rong Tong Hydro Power Station, District – Lahaul and Spiti, Himachal Pradesh
Site characteristics:	
Annual Temperature Range	-40°C to 30°C
Precipitation	Mostly in the form of Snow – up to 6 ft. in the Winter Months
Seismic Zone (Geological Survey of India, 2014)	Lahaul and Spiti district falls in seismic zone 4 and 5
Design elevation	12,000 feet above sea level
Electrical infrastructure: AC system interconnection requirement at Point of Connection (PCC)	22 kV, 50 Hz, 3 phase, wye or delta, 3-wire or 4-wire The BESS will be connected to Host Utility grid at site-specific voltage, frequency, and phase configuration. The BESS shall be designed for maximum flexibility with regard to site-specific voltages, frequency, phase imbalance, and protection requirements.
Electrical infrastructure: Expected variations in voltage, frequency and phase imbalance at PCC	Voltage: ±15% (Poor due to nearest substation at 120 km) Frequency: 49.5 Hz to 50.2 Hz

	Phase Imbalance: ±3%

70.2 BESS Interconnection

The BESS will be interconnected with the Host Utility grid at PCC. It is expected that the PCC will be at the Host Utility low-voltage ac bus or feeder or at the low-voltage terminals of a Host Utility distribution class transformer, whichever is applicable. However, the same must be finalized by the Contractor after consultation with the Host Utility.

70.3 Grid Characteristics

The BESS shall be capable of continuous operation under variable voltage, frequency and phase imbalance conditions at the PCC, as described in Table-1. Information on available fault current and other characteristics of the Host Utility grid will be provided by the Host Utility. The Contractor shall confirm, for each Host Utility site, that this information has been received and understood during the site-specific engineering phase.

70.4 Codes and Standards

IEC 61427	Secondary cells and batteries for renewable energy storage for On-grid applications: Non-chemistry Specific (applicable to all secondary battery types)
UL1973	Energy storage for stationary applications such as for PV: Non-chemistry Specific (applicable to all secondary battery types)
IEC 62485-2	Safety requirements for secondary batteries and battery installations - to meet requirements on safety aspects associated with the erection, use, inspection, maintenance and disposal: Non-chemistry Specific (applicable to all secondary battery types)
IEC 61508	Functional Safety of Electrical/Electronic/Programmable Electronic Safety-related Systems: Applicable for all Battery Energy Storage Systems
UL 1642	Standard of Lithium Batteries (Safety of Lithium Ion Batteries)
IEC 62281	Safety of primary and secondary lithium cells and batteries during transport: Applicable for storage systems using Lithium Ion chemistries
IEC 61850/ DNP3	Communications networks and management systems. (It shall be ensured that PV Plant SCADA and the BESS control system communicate with each other over the protocol and the combined parameters are accessible over a common HMI.)

71 Technical Specification of Battery Energy Storage System

71.1 Procurement-Specific Ratings and Requirements

Table-2 below specifies project-specific BESS capabilities and ratings for this Project.

Table 2: Supply-Specific Ratings and Requirements

Item Description	**Requirement**
Battery Technology	Any battery technology with totally Maintenance Free suitable for operation in site-specific climatic conditions can be used.
Rated No of Cycles (Minimum)	4000 cycles at rated energy capacity at 80% Depth of Discharge (DoD) at 25°C and C/3 Rate of Discharge
Nameplate watt rating*, AC (A) Nameplate watt-hour rating, ac (B)	1 MW, continuous 1 MWh at 1 MW net ac output at the beginning of life and not less than 80% of this capacity at any point of time up to End of Battery Life.
System ac-dc-ac efficiency*:	75%
Use case requirements	Peak Management Voltage Support Frequency Regulation (demonstration only) Intermittent Resource Support
Peak Management	Yes Morning and evening (preference to evening) No. of days per year: up to 365 In the Peak Management Use Case scenario, power generated during the early and midday periods shall be stored in the BESS and released later in the day, during peak demand. In this case, the BESS shall be discharged in the Peak Limiting profile in the late afternoon. To the extent that the total energy dispatched does not exceed the nameplate watt-hour rating, the BESS may be further discharged in Constant Power Mode after Part 01 (Solar PV Plant) is no more generating.

	One discharge cycle per day is envisaged in this use case.
VAR compensation /voltage support (VC/VS)	Yes
Intermittent resource support (IRS)	Yes This use case is envisaged to be employed during the day, primarily to support variations in Solar PV generation. The days for operation in this use case shall be determined in consultation with the Owner/Host Utility.
Black Start Capability	Yes
Ventilation System inside the Container	Should be such as to maintain minimum and maximum Temperature as recommended by the manufacturer for optimum performance of the batteries on continuous basis.
Grid Charging	Allowed with the discretion of grid operator. If the BESS is charged through the grid, the energy consumed shall be considered part of the Auxiliary power and shall be metered.
To be verified as per the procedure described in Annexure-E to this Section for Performance Guarantee Tests and to be verified on annual basis as per Schedule. All measurement instruments for conducting the tests shall be maintained by the Contractor.	

71.2 Additional Information and Requirements for Frequency Regulation Use Case

This Clause provides information regarding the anticipated energy dispatch under the frequency regulation use case, as described in Clause 71.4. However, the same may be altered as per Control Strategy proposed so as to allow minimum Energy Imbalances.

Table 3: Additional Information and Requirements for Frequency Regulation Use Case

Item Description: **Frequency Regulation Use Case**	**Requirement**
Maximum BESS power level for frequency regulation	Discharging: 50% of nameplate watt rating Charging: 50% of nameplate watt rating

71.3 Additional Information and Requirements for Intermittent Resource Support Use Case

This section provides information regarding the anticipated energy dispatch under the intermittent resource support use case, as described in Clause 71.5.

Table 4: Additional Information and Requirements for Intermittent Resource Support Use Case

Item Description: Intermittent Resource Support Use Case	**Requirement**
Voltage flicker compensation:	Yes Compensate for all changes in intermittent resource output power level that exceed 10% per second and in which the new power level remains for at least 5 seconds. The Maximum system Power level for Voltage flicker compensation during discharging and Discharging to be determined during detailed system design in terms of % of nameplate watt and VAR rating.
Ramp rate control: period of operation	To be specified in design
Ramp rate control (Power level of the BESS shall decrease at a linea rate)	1 MW/min Maximum BESS power level for charging and discharging to be determined at the time of detailed system design in terms of % of nameplate watt and VAR rating.
Intermittent resource generation following: daily schedule and combined power output	Suggested Scheme (to be finalized during detailed design stage): Charging during morning up to noon and other off-peak periods Begin discharging in load following mode in the afternoon (coinciding with Peak Demand in the evening) Conclude discharging at 08:00 PM Combined Power output of Intermittent resources (Part 01 and Part 02) and BESS to be 1.5 MW at unity power factor. Maximum BESS power level for charging and discharging to be determined at the time of detailed system design in terms of % of nameplate watt and VAR rating.

Intermittent resource generation following: period of operation	
Warranties	Ten (10) year parts and labour warranty for the entire BESS and its constituent equipment.

71.4 Frequency Regulation

The BESS shall be capable of both charging and discharging, at the power level or levels specified in Table-3 above, in response to an external signal (such as an automatic generation control signal). FR may occur for as much as 24 hours per day and for as much as 365 days per year. FR operation would not be simultaneous with any other real power discharge or charge, but it may occur simultaneously with supply of reactive power.

71.5 Intermittent Resource Support

The BESS will support the integration of solar PV plant into the grid by either eliminating or reducing undesirable voltage and power fluctuations on the Host Utility feeder or by firming the power delivered by the resource (that is, augmenting the power produced so that an expected output may reliably be achieved).

71.6 Nameplate Ratings

71.6.1 Overall System Real Power and Energy Ratings

During discharge, the BESS shall be rated to supply at the PCC the continuous net ac real power and ac energy output specified in *Table 2: Supply-Specific Ratings and Requirements* above. These ratings shall be referred to in all project documentation, including this specification, as the nameplate watt rating and the nameplate watt-hour rating. All nameplate ratings shall be achievable over the End of Battery life, as specified in Clause 73.5.1. The nameplate watt rating and nameplate watt-hour rating shall be achievable during discharge for the full range of stated environmental conditions, provided that the battery is fully charged and the HVAC system (if incorporated in the BESS) has stabilized. In any case, the BESS shall be capable of being discharged at reduced power levels from that specified above. However, in no case will the energy discharged from the battery be greater than the nameplate watt-hour rating.

The Contractor shall clearly state in its O&M manual as well as during design review the expected efficiencies of the major subsystems (battery, PCS) as well as the expected losses from auxiliaries.

Note: There may be specific requirements on the attainable power level during charging, which the Contractor may need to identify in co-ordination with the grid operator/Employer. However, unless otherwise specified in those sections, the real power level attainable during

charging shall be at the Contractor's discretion, so long as the other charging requirements in this specification are met.

71.6.2 Overall System Reactive Power Rating

In accordance with the VAR-related control modes identified in Clause 23, the BESS shall be capable of dispatching both leading and lagging reactive power at the PCC, up to the rated VAR capacity specified in Table-2, regardless of whether the battery is being simultaneously discharged or charged. This rating shall be referred to in all project documentation, including this specification, as the nameplate VAR rating. The BESS shall be capable of simultaneously producing real and reactive power as long as no nameplate rating is exceeded. That is, the combination of operation at full nameplate watt rating and full nameplate VAR rating shall not exceed the nameplate VA rating.

72 BESS Use Cases

The BESS shall be capable of operating over its entire life in one or more of the use cases described in this section to meet the system requirements specified in Table-2, and further detailed in the NIT.

The possible use cases supported by this technical specification include the following:

- Peak management (PM)
- VAR compensation /voltage support (VC/VS)
- Frequency regulation (FR)
- Intermittent resource support (IRS)

The use cases should not be interpreted as either operating modes or control functions.

Clause 74 presents the requirements for the BESS control functions that are required to operate the BESS in a manner that supports these use cases. While Use cases describe what the BESS will be used for, whereas control functions describe how the equipment will be operated to achieve those uses. Mapping of the control functions to the use cases is provided in Clause 74, Table 7.2.

The purpose for defining and describing the use cases is to provide the Contractor with essential information needed to ensure that the BESS will have the desired life and performance characteristics. In particular, the requirements listed in this section should support Contractor's efforts to accomplish the following:

- Determine other BESS subsystem performance capabilities
- Understand the various combinations of uses that the Host Utility may exercise

The operation of the BESS at the Host Utility site may also include some combination of the above use cases. The possible (or required) combinations are described in Clause 72.5.

Each use case description in the following subsections includes a capability requirement for a

number of cycles and days per year of operation in that use case. On days of the year in which a particular use case is not being used, the BESS shall be considered available for operation in some other use case, so long as the nameplate ratings specified elsewhere (see Clause 71.6.1, Clause 71.6.2 and Clause 73.9.2) are not exceeded. Simultaneous operation in two or more of the real power use cases (PM, FR, IRS) is not required, but it may be optionally provided at the discretion of the Contractor, so long as no nameplate rating is exceeded. In accordance with Clause 71.6.2, simultaneous operation in the VC/VS use case together with one of the other use cases is a required capability.

Important Note: The various use cases described below represent a wide range of battery and PCS capabilities. The BESS shall be designed to accommodate the most stringent of the intended operation scenarios so that any of the scenarios can be exercised without exception. The use cases described in this Clause 72 presuppose the provision of a suitably designed control system, as outlined in Clause 74 of this specification. Accordingly, the descriptions of the use cases must be read and understood in conjunction with the description of the control functions specified in Clause 74.

72.1 Peak Management (PM)

In the PM use case, the BESS is controlled to reduce peak power demand on the Host Utility feeder to which the BESS is connected. The BESS would be discharged at any power level up to the maximum power level specified as the nameplate watt rating (see Clause 71.6.1). The BESS shall support operation in this application for up to the number of times per year specified, if any, in Table-2. In this Use case, each daily operation is expected to consist of one discharge and charge cycle, in either a variable or a constant power output, as described below.

In that event that two discharges are required in a day, the maximum number of days per year that the system would operate with two daily discharges is one-half the number of days in single-daily-discharge mode. In the case of two discharges in a single day, it may be desirable for the Host Utility to charge the battery between the two discharges (opportunity charging) and the BESS shall permit such operation. For example, a morning and afternoon peak may be shaved, with a partial (or complete) recharge taking place during the day between the morning and evening peaks.

Note: Specification of the number of days per year for the two-daily-discharges scenario at half those for the single-daily-discharge mode is based on the assumption that opportunity charging between daily cycles would fully restore battery capacity, so that each of the two discharges in the day would take place at the full nameplate watt-hour rating. If each discharge were less than the nameplate watt-hour rating, the PM operation in a two-daily-discharges scenario could potentially occur on more days per year.

Two different power dispatch profiles during discharge are specified, as described in the following two subsections.

(i) Constant Power

The BESS is discharged at a single, constant power level for a specified duration. The dispatch power level may be any value less than or equal to the nameplate watt rating. The duration of the constant power discharge may be any period of time (up to six hours), so long as the total energy dispatched to the load does not exceed the nameplate energy rating of the BESS or exceed any other operational or safety limits.

(ii) Peak Limiting

The BESS is discharged at a varying power level proportional to the amount by which the actual load on the Host Utility feeder or substation transformer exceeds a desired value. The dispatch of power from the BESS in this case would mirror the shape of the Host Utility load (which may be, generally, sinusoidal in shape). The duration of this discharge may be several hours, so long as the total energy dispatched to the load does not exceed the nameplate energy rating of the BESS or any other operational or safety limits. As an example, with the BESS installed at a distribution substation, the load on the secondary winding of the substation transformer would be monitored and sent to the control system. The Host Utility operator would enter a set point, and the BESS would operate so as to prevent or reduce overloading of the transformer by serving some (or all) of its entire peak load.

Actual discharge profiles may vary with respect to overall shape, number of peaks and valleys per day, ramp rate, and overall duration of discharge, including possible standby time between successive peaks. The Contractor shall specify all operational and warranty-specific limitations on the use of the battery for the two different power dispatch profiles.

72.2 <u>VAR Compensation/Voltage Support (VC/VS)</u>

The BESS shall be capable of supporting voltage on the Host Utility feeder to which it is connected by the injection or absorption of both real and reactive power (VARs). This operation shall be possible during real power discharge or charge and during standby. The operation may be dynamic (continuously varying reactive/real power output) or static (operation at a fixed power factor).

In this use, it shall be possible for the Host Utility to determine the priority of operation and/or the level of reactive power support desired, including different levels for leading and lagging VARs, as well as precedence of reactive power over real power or real power over reactive power. Specifically, it shall be possible to give either real power or reactive power the higher

priority, so long as the nameplate VA rating (see Clause 71.6.271.6.2) is not exceeded. In this use, the BESS shall be capable of responding to both real-time and pre-programmed control signals (see Clause 74).

(i) VAR Compensation Option

The intent of VAR Compensation is that the BESS be capable of carrying out the basic functions of a synchronous generator having the option to include injection voltage control/reactive power consumption and limitation of active power when the effect of the reactive power is not sufficient. It uses a progressive curve, whereby the higher the deviation is from the target voltage, the greater is the effort to correct the deviation. It may be necessary to automatically disable over frequency or under frequency protection during operation in VC/VS mode. The Contractor shall coordinate this with the Host Utility.

72.3 Frequency Regulation (FR)

The BESS shall be capable of both charging and discharging, at the power level or levels specified in Table-2, in response to an external signal (such as an automatic generation control signal). FR may occur for as much as 24 hours per day and for as much as 365 days per year. FR operation would not be simultaneous with any other real power discharge or charge, but it may occur simultaneously with supply of reactive power.

72.4 Intermittent Resource Support

The BESS will support the integration of solar PV plant into the grid by either eliminating or reducing undesirable voltage and power fluctuations on the Host Utility feeder or by firming the power delivered by the resource (that is, augmenting the power produced so that an expected output may reliably be achieved).

In IRS use, the BESS shall respond to one of two classes of controlling signals: (1) the voltage at the electrical connection point or PCC and (2) the output power level of the intermittent resource (or some other power level signal). Several scenarios are possible, as described in the following paragraphs.

(i) Voltage Flicker

In a voltage flicker control scenario, the BESS shall be dispatched to control rapid but small (such as 2% to 5%), potentially frequent changes in voltage on the utility feeder that produce voltage flicker at other customer loads on the feeder. The flicker standard to be implemented shall be determined during detailed design stage in consonance with the regulation of the jurisdiction having authority.

The control signal is the power output level of the solar PV plant. Drops in power shall be compensated by a discharge of the BESS, whereas increases in power shall be

compensated by a charge of the BESS in accordance with a specified scheme (to be finalized during detailed design stage). The BESS shall respond instantaneously for each qualifying power level change and then immediately begin a ramp to zero power with a specific ramp rate.

Depending on a number of factors—including the size of the intermittent resource compared to the native feeder load, the impedance of the feeder, and the location of the BESS and the intermittent resource relative to one another—voltage flicker may be improved by the BESS providing either real or reactive power or both in response to either variations in the voltage at the electrical connection point or variations in the output power level of an intermittent resource. The output of the BESS (either discharge or charge) shall be instantaneous in response to a change in the monitored quantity, followed by a ramp to zero over a settable period of time.

(ii) Ramp Rate Control

In a ramp-rate-control scenario, the BESS shall be dispatched to limit the rate of power change up or down (ramp rate) from the intermittent resource so that large step changes in power output are smoothed over time to produce a controlled ramp (up or down). Ramp rate control is effectively the same as voltage flicker control from the point of view of power in or out of the storage system except that the goal, for example, is to limit the operation of automatic voltage regulators and tap changers on the feeder or at the substation that are caused by relatively larger changes in output of the intermittent resource.

The control signal is the power output level of solar PV plant. Drops in power shall be compensated by a discharge of the BESS, whereas increases in power shall be compensated by a charge of the BESS in accordance with a specified scheme (to be finalized during detailed design stage). The BESS shall respond instantaneously for each qualifying power level change and then immediately begin a ramp to zero power with a specific ramp rate.

The BESS shall be dispatched in response to variations in power at the point of concern, whether it is the feeder at the electrical connection point or the output terminals of the intermittent resource. The output of the BESS (either discharge or charge) shall be instantaneous in response to a change in the monitored quantity, followed by a ramp to zero over a settable period of time. The maximum output (either discharge or charge) of the BESS shall be specified in the detail design Scheme.

(iii) Generation-Following

In the generation-following scenario, the BESS shall be dispatched to follow the output power from the intermittent resource(s) part of the Plant Facilities to compensate for its variability. The output from the BESS shall be controlled to produce a resultant power output level from the same. The desired level of the resultant power shall be settable. The BESS shall charge the battery with energy from the renewable sources, as determined in consultation with the Owner. The BESS shall discharge the battery so that the output of solar PV plant plus battery is a constant (see Table -2). During the recharge operation, the charging power level should be such that the net output of the array is kept more or less constant (that is, array power momentary dropouts should be compensated to the extent possible during recharge).

In the most general case, both discharge and charge operations will occur depending on the maximum power output capability of the solar PV plant relative to the battery storage system capability, the desired power set point, the window of operation of the storage, and the variations in output of the resource.

Actual discharge profiles in the IRS use case may vary with respect to overall shape, number of peaks and valleys per day, ramp rate, and overall duration of discharge, including possible standby time between successive discharges or charges. The Contractor should specify all operational and warranty-specific limitations on the use of the battery for different dispatch profiles.

72.5 Combination Use Case Requirements

On days of the year in which a particular use is not active, the BESS shall be considered available for other uses, so long as the nameplate ratings specified elsewhere (see Clauses 71.6.1, 71.6.2 and 73.9.2) are not exceeded. Simultaneous operation in two or more of the real power use cases (PM, FR, IRS) is not required but may be optionally provided at the discretion of the Contractor, so long as no nameplate rating is exceeded. In accordance with Section 19.8.2, simultaneous provision of VAR support (VC/VS) with other use cases is a required capability.

The BESS shall be capable of operating in several combinations of use cases, like Peak Limiting plus Frequency Regulation, Peak Limiting plus Voltage Flicker, Peak Limiting plus Ramp Rate Control. On any given day of the year, only one of these two dispatch profiles would be executed.

72.6 Charging Requirements

The control system shall allow the Host Utility to initiate a specified or programmed charge cycle. The Contractor shall work with each Host Utility to ensure that the Host Utility's requirements are met to the full capability of the BESS and that the battery is properly charged

in all anticipated uses. The O&M manual supplied with the BESS shall clearly and in a detailed manner describe all charging requirements and shall guide the user in ensuring that charging of the battery is properly carried out.

73 Design, Fabrication, and Construction Requirements of BESS

73.1 General

The methods and materials specified in this technical specification are intended to represent minimum requirements. Reliance thereon shall not diminish the responsibility for meeting performance and other requirements stated in this technical specification.

The design of the BESS shall incorporate the principle of modularity, with a view to reducing life-cycle costs and ease of replenishment of storage capacity while facilitating ease of maintenance, space requirements, and reliability. The design should also facilitate rapid and easy replacement of the unit batteries without significant downtime. Specifically, the BESS should be designed so that battery replacement is not necessitated within the first five years of operation considering the remoteness of the project sites. Overall, the design philosophy shall be to minimize and optimize all costs to the Employer, not simply initial capital costs or low maintenance costs.

Life-cycle costs include the following: initial system cost, unit battery replacement cost, periodic equipment upgrades, maintenance costs, auxiliary system energy consumption, charging energy costs (that is, costs due to overall battery and PCS losses), and any other contributors to life-cycle energy cost.

73.2 System-Level Design and Performance Requirements

73.2.1 The major equipment items shall include a battery, battery management system (BMS), PCS, output/isolation transformer, and SCADA which is to be integrated with the solar plant SCADA system defined elsewhere in this document. Additional equipment shall include HVAC, wiring, connectors, protective devices, grounding, junction boxes and enclosures, instrumentation, enclosures, and all other items needed for a fully functional, grid-interactive BESS to meet the requirements set forth in this specification. All systems and components of systems—including electrical storage unit, switching devices in the PCS, components of monitoring and control systems, and components of auxiliary systems— must use proven and previously demonstrated technology. Electrochemical cells, PCS switching devices, and control system hardware and software must be commercially available and in use for other markets. Electrochemical cells must be replaceable (in small orders) with a maximum six-week lead time under normal business conditions. Designs using experimental or otherwise undocumented components are not permitted.

73.2.2 The BESS shall be characterized using language and methods consistent with IEEE 1679,

"Recommended Practice for the Characterization and Evaluation of Emerging Energy Storage Technologies in Stationary Applications."

73.2.3 The BESS shall be IEEE 1547 (Standard for Interconnecting Distributed Resources with Electric Power Systems)–compliant, where possible.

73.2.4 The prudent design of the BESS should include careful consideration of resonance and Ferro-resonance.

73.3 Containerization and Transportability

73.3.1 The BESS shall be containerized, using either standard International Organization for Standardization (ISO) 668 shipping containers or custom-designed power equipment centres. The container or containers shall be designed to be drop-shipped onto a properly prepared pad or foundation (such as compacted soil, concrete pad or platform, and so on). When fully installed, all BESS components—including battery racks all auxiliaries, such as HVAC and fire suppression systems, step-up transformers to match grid, ac switchgear, and so on—and tools shall be enclosed in (or on) the containers, even if certain components must be separately shipped and installed at the site.

73.3.2 Containers shall be designed and constructed to meet IP54 and NEMA 3R requirements, which protect the equipment inside from harmful effects resulting from the ingress of water, dirt, dust, and wind. The design and installation of Containers shall meet relevant regulatory requirements for occupational safety and health under national and state legislations.

73.3.3 All containers and packaging of separately shipped components shall be suitable for land or sea transport, including offering suitable protection of the equipment inside against damage from weather and vibration or shock from transportation.

73.3.4 The containers and their contents shall be designed to be easily prepared for transport, shipped, connected and operated at site. The Contractor shall ensure that all required bracing and shipping stabilization equipment to enable transport is either kept at hand or brought to the site in a timely manner before transport.

73.4 Additional transportability requirements and/or clarifications

73.4.1 In designing for transportability of the lithium-ion batteries, the Contractor shall follow the relevant guidelines (Sub-section 38.3) set forth in the United Nations document "Recommendations on the Transport of Dangerous Goods—Manual of Tests and Criteria" (ST/SG/AC.10/11/Rev.5), with specific reference to obtaining UN38.3 and UN3480 certifications at the battery module and/or container level.

73.4.2 The BESS container or containers shall be of a size and weight to be capable of being transported to project sites with due consideration for the load bearing restrictions imposed by bridges, if any, and rarefied atmospheric conditions in the region.

73.4.3 Containers shall incorporate standard lugs or other means for lifting by crane or shall be properly palletized for movement with forklift trucks, or both.

73.5 Design Life and Life-Cycle Costs

73.5.1 End of battery life – End of battery life is that point in time when the BESS can no longer meet the power and/or energy discharge requirements of this Specification due to age or non-repairable malfunction of the battery subsystem, and/or non-replaceable components. When the system is no longer able to provide these requirements, the system has reached its end of life. Battery End of life shall be not less than 10 years from the date of Commissioning.

73.5.2 It shall be the responsibility of the Contractor to make periodic replacements/replenishments of unit batteries, if and when required, up to the End of Battery Life as described above. Outage time as a result of replacement will also be counted as an "Accountable BESS Outage" for the purpose of computing BESS Availability.

73.6 Reliability, Availability, and Operability of the BESS

The BESS shall be designed for high reliability, defined in the following terms:

Starting reliability: (99% starting reliability means that the unit shall start in 99 of 100 attempts)

Mean-time-to-repair- The time taken from the time of notification of a need for repair to the time of completion of repairs (that is, inclusive of time for arrival of spare parts and repair personnel at the location of the BESS)

Availability

Availability is the percentage of hours that the BESS is available during the year. The availability guarantee shall begin upon facility commissioning. Annual availability shall be calculated as follows:

$$[1 - \left(\frac{\sum Accountable\ BESS\ Outage\ duration\ in\ hours}{8760} \right)] \times 100$$

Where:

- *Accountable BESS outages* are outages caused or necessitated by the BESS equipment that result in reduced capacity or loss of essential function of the BESS. These outages may be initiated by failure of components, loss of battery capacity (to the extent that End of Battery Life is not reached), operation of protective devices, alarms, or manual action. Such outages include both forced outages due to equipment problems and scheduled outages for BESS maintenance.
- *Accountable BESS outage duration* is the elapsed time of accountable BESS outages from the instant the BESS experiences reduced capacity or is out of service to the

instant it is returned to service or full capacity. If the BESS experiences reduced capacity but is determined by the Employer to be available for service even if the Employer elects not to immediately return the equipment to full capacity, such time will be discounted from the outage duration.

- The Procurement specific nameplate ratings shall be as defined in Clause 71.1 above. The BESS shall be considered to be under an accountable outage if any of those ratings cannot be met. The BESS shall also be considered to be under an accountable outage if a scheduled (or required) charge cycle cannot be completed.
- The data required for assessment of the availability of the BESS shall be collected through the Plant's integrated SCADA system.

73.6.1 It shall be possible to fully remove, repair, and replace in the field any failed or poorly performing component within a day, assuming that spare parts, test equipment, and maintenance personnel are on the site. This capability shall be demonstrated in the factory acceptance test (FAT) for unit batteries and other key components.

73.6.2 The BESS shall be capable of unattended operation, with provision of remote monitoring and control.

73.7 Planned Maintenance Outage

Up to 5 weeks each year will be permitted for a planned outage to perform any required maintenance. The Contractor shall provide a guarantee for the maximum length of time required for this type of maintenance operation.

73.8 Battery Subsystem Design Requirements

73.8.1 Electrochemical Cells

Only cells that are commercially available or for which suitable (not necessarily identical) replacement cells can be supplied on short notice will be allowed. *For both premature cell failures and end-of-battery-life replacement, the Contractor shall guarantee cell availability and the length of down time (hours or days) required to replace cells.* The cells may be supplied as separate, individual units or as group of cells combined into modules. The cells shall meet the seismic requirements for the planned location of the BESS. Cell and module design shall accommodate the anticipated vibrations and shocks associated with the transportation of the BESS and shall resist deterioration due to vibrations resulting from the same. Associated hardware and paraphernalia should also be able to withstand the rigors of transportation. The transport plan shall be shared with the Employer and approved prior to dispatch.

73.8.2 Labelling of the cells or unit batteries shall include manufacturer's name, cell type, nameplate rating, and date of manufacture, in fully legible characters. All cells shall be traceable to the

point of origin for purpose of addressing safety issues.

73.8.3 Electrochemical Storage System

73.8.3.1 The storage system may consist of one or more unit batteries. If the storage system consists of more than one unit battery, these may be electrically interconnected in any desirable series and parallel configuration to achieve the overall system storage and power rating requirements.

73.8.3.2 Each electrically series-connected string of unit batteries shall include a means of disconnecting the string from the rest of the system and of providing over-current protection (during a fault). The means of disconnect shall provide for a physical interruption of the string electrical circuit, which shall be visible to anyone servicing the individual unit batteries in the string and shall be capable of being locked or secured in an open position.

73.8.3.3 If the disconnect means consists of removal of a unit battery, the storage system shall be designed to allow maintenance personnel to determine that there is no current flowing in the string and provisions to ensure that the PCS is off before the unit battery is removed. Procedures for maintenance and/or field replacement of unit batteries shall neither require nor recommend removal of the unit battery without first ensuring that no current is flowing in the string circuit.

73.8.3.4 Over-current protection, whether on the ac or dc side, in paralleled unit battery strings shall be sized and coordinated so that currents from other strings do not contribute to a fault in any unit battery string.

73.8.3.5 Where appropriate, dc wiring shall be braced for available fault currents. Protection shall include a dc breaker, fuse, or other current-limiting device on the battery bus. This protection shall be coordinated with the PCS capabilities and battery string protection, and shall take into account switching or other transients and the inductance/resistance (L/R) ratio at the relevant areas of the dc system. The Contractor shall produce a fault analysis and protection coordination study for the battery dc subsystem during final design. *The Employer reserves the right to withhold permission to ship the BESS until the fault analysis has been satisfactorily completed.*

73.8.3.6 Cells, wiring, switch gear, and all dc electrical components shall be insulated for the maximum expected voltages plus a suitable factor of safety.

73.8.3.7 The battery system shall include a system to detect and alarm excessive ground leakage current levels. Ground fault detection shall be enabled for the container or, if more than one electrical series string is installed in the container, for each series string. The detection/trip level shall be field adjustable. The Contractor shall have overall responsibility for the safety of the electrical design and installation of the battery, as well as all aspects of the BESS.

73.8.3.8 The battery system shall include a monitoring/alarm system and/or prescribed maintenance

procedures to detect abnormal unit battery conditions and notify proper personnel of their occurrence.

73.8.3.9 Abnormal conditions shall include but not be limited to (1) weak unit batteries that could reasonably be expected to fail to provide rated capacity upon full discharge, (2) high-resistance or open-unit batteries, (3) high-resistance or open external unit battery connections, (4) unit batteries with temperatures exceeding operating thresholds, and (5) internally shorted unit batteries. Unit battery monitoring, whether automatic or manual, should be specified to alert the proper personnel in a timely manner that an abnormal unit battery condition exists or may exist. All alarms shall be part of the control system and shall include remote display or annunciation capability.

73.8.3.10 The unit batteries shall be racked or shall be housed in stackable modules. The unit batteries or cells shall be arranged and installed to permit easy access for equipment and personnel. The moveable units shall be arranged and installed to permit easy access for equipment and personnel to carry out unit removal and replacement activities. For all systems, it shall be possible to remove and replace a prematurely failed unit battery or cell (as appropriate), when system performance specifications cannot be met. The lengths and widths of all aisles and spaces into which personnel may enter in the field for operations and/or routine or unscheduled maintenance purposes, as well as egress routes from these aisles and spaces, shall conform to applicable codes and standards. All racks and metallic conductive members of stackable modules shall be grounded to earth. Racks shall meet the seismic load and road vibration requirements and shall include means to restrain cell movement during seismic events and transport. The Contractor shall furnish analyses and/or other data that show that the rack and cell designs are designed to meet all potential seismic and transport vibration requirements.

73.8.3.11 The design of all modules and racks shall specifically account for the anticipated vibrations and shocks associated with the periodic transportation of the BESS.

73.8.4 Cell/Battery Auxiliary Systems

The cells and battery system shall be supplied with all required and/or recommended accessories. This includes inter-cell connectors and monitoring devices for cell temperature and cell voltage, if required.

73.9 Power Conditioning System Design Requirements

73.9.1 General

73.9.1.1 The PCS is the interface between the DC battery system and the AC system and provides for charging and discharging of the battery. The PCS may consist of one or more parallel units. Paralleling may be at the DC or AC terminals. Line-commutated systems or systems

that require the presence of utility voltage or current to develop an AC output are not acceptable. The PCS circuit topology shall be voltage source (that is, the PCS at its AC terminals shall appear to the grid as a voltage source rather than as a current source and, at its DC terminals, shall be capable of reversing current flow in the battery without reversing the polarity of the DC bus).

73.9.1.2 All load-carrying cables within the PCS subsystem shall have a suitable load factor of safety. The PCS shall preferably be air-cooled suitable for the site climatic conditions, with final rejection of waste heat to the ambient air. The air-handling systems shall include filtering that is adequate to keep dust from the interior of the PCS system.

73.9.1.3 The PCS shall be housed within one or more appropriate weatherproof and dustproof enclosures, with provisions to prevent moisture condensation and to prevent the entrance of water, airborne salt or dust, rodents, insects, and/or similar materials or pests into air intake/exhaust ports.

73.9.2 Power Conditioning System Rating

The PCS shall be capable of delivering Real power as specified in Table-2. This rating shall be referred to in all project documentation, including this specification, as the nameplate VA rating. To account for losses in the PCS, the DC input power to the PCS will be higher than the rated PCS output power. The available DC input power will be the BESS nameplate watt rating divided by the PCS full load efficiency (as specified in the datasheet) during discharge.

73.9.3 Power Conditioning System Protection and Control

The PCS, in conjunction with the control system, shall be capable of completely automatic, unattended operation, including self-protection, synchronizing and paralleling with the grid, and disconnect. The control of the PCS shall be integrated with the overall BESS controls.

The PCS shall include all necessary self-protective and self-diagnostic features to protect itself from damage in the event of component failure or the excursion of operating parameters beyond a safe or expected range. This includes excursions due to internal or external causes. The self-protective features shall prevent the PCS from being operated in a manner that may be unsafe or damaging. Faults due to malfunctions within the PCS, including commutation failures, shall be cleared by the PCS over-current protection device(s).

73.9.4 Power Conditioning System AC Interface with AC bus

73.9.4.1 The BESS must meet applicable harmonic current and voltage specifications in accordance with applicable standards. Harmonic suppression may be included with the PCS or at the BESS AC system level. However, the Contractor shall design the BESS electrical system to preclude unacceptable harmonic levels in the BESS auxiliary power system.

73.9.4.2 In addition to interconnection standards specified in this document, there may be specific

requirements for interconnection, which need to be ascertained by the Contractor in co-ordination with the distribution utility at each site.

73.9.4.3 The PCS transformer may be used to aid in harmonic cancellation and may include tertiary windings to supply BESS auxiliary power requirements. The transformer must be dry type. The PCS shall include provisions for disconnect on both its AC and DC terminals for maintenance work. Conductor separation must be clearly visible. The detailed maintenance procedure shall be addressed in the O&M manual.

73.9.4.4 Electromagnetic Interference

The PCS shall not produce electromagnetic interference (EMI) that will cause mis-operation of instrumentation, communications, or similar electronic equipment within the BESS.

73.9.4.5 Islanding

The PCS design shall include provisions to limit run-on and islanding as per applicable standards upon the loss of grid. This capability shall be demonstrated to the Employer's satisfaction during the FAT.

73.10 AC System

The BESS AC system includes all switch gear, bus work, cable, connectors, transformers, and protective relaying required for connecting the BESS at the PCC. The Contractor shall design, procure, ship, and assemble on-site all ac interconnection equipment on the BESS side of the PCC. On-site assembly of Contractor supplied equipment shall be coordinated with the utility. The Contractor shall design, fabricate, ship and install all cabling required for connecting the BESS to the PCC. The BESS AC system shall include potential transformers, current transformers, and any other metering equipment so that the performance monitoring and documentation requirements of this specification can be met. Metering accuracy shall meet applicable standards.

73.11 Protection and Control

73.11.1 The power system (PCS), AC and DC switchgear/protective devices) shall be designed to provide safe, reliable operation with minimum interruption. Reliable operation shall be supported by a sensitive and properly coordinated protection system. The protection system shall be capable of monitoring significant operating parameters and sensing all abnormal operations or fault conditions. It shall isolate the faulted circuits or components without causing damage to other circuits and components of the system. The protection system shall also provide adequate indications and/or alarms for identification of the faulted circuits, components, and abnormal conditions, allowing preventive action and rapid restoration of service.

73.11.2 The grid may have its own protective schemes at the point of common connection (PCC) that

will be the responsibility of the Contractor to be fulfil.

73.11.3 Integration of the protective relaying and metering into the BESS controls shall not circumvent normal protective relaying. Protection shall not be interlocked with the position of any isolating/interrupting devices.

73.11.4 The BESS shall provide breaker failure protection for the primary interrupting device (that is, breaker, high-voltage interconnect, low-voltage interconnect) that is responsible for disconnecting the BESS and/or high-voltage ground sources from the distribution system.

73.11.5 The BESS shall be capable of interrupting line-to-line fault currents and line-to-ground fault currents available at the PCC and flowing in the Contractor's equipment in either direction for faults on either side of the PCC. Faults due to malfunctions within the BESS shall be cleared by the BESS protective devices.

73.11.6 The BESS must have low-voltage ride-through capabilities according to extant Technical guidelines on connectivity.

73.11.7 BESS and high-voltage ground sources should be disconnected from the distribution system and the system operators must be notified if any of the following occur:

- The BESS local interconnection protection system fails
- The interrupting device fails.
- The dc supply is lost
- The signal channel fails

The BESS interconnection protection must be capable of distinguishing between external faults on the distribution system and internal faults within the facility. The automatic reconnection scheme must be disabled for faults occurring within the facility.

The BESS shall include provisions to protect against transient voltage surges from switching, lightning, and similar causes, in accordance with applicable standards. The overall PCS design shall also limit surges on the dc bus to twice the normal maximum DC bus voltage.

73.12 Auxiliary Power

The BESS shall include an auxiliary power system (separate or same as the Solar Plant auxiliary system) derived from the utility AC bus, the PCS transformer low-side bus, PCS transformer tertiary winding, or similar means with metering. The auxiliary power system shall include all step-down transformers, breakers, fuses, motor starters, relaying, panels, enclosures, junction boxes, conduits, raceways, wiring, and similar equipment, as required for the BESS operation. The auxiliary power system shall include separate potential transformers and current transformers, so that auxiliary power consumption can be measured and electronically recorded in real time, independently of operation of the PCS or of net power flows to and from the battery. The auxiliary power system and/or control system design shall

provide for whatever emergency power is necessary for an orderly system shutdown during abnormal conditions such as a loss of grid power. The auxiliary power system and/or control system design shall also provide for the capability to restart automatically after BESS shutdowns of several days.

74 Control and Communication

74.1 Control System General Requirements

The control system shall be designed to provide for automatic, unattended operation. The control system design shall provide for local manual operation and remote operation or dispatch from a remotely located computer. The control system shall be programmable for establishing or adjusting all parameters, set points, algorithms, limits, and so on that are required for effective operation as described in this specification. The control system shall be designed to prevent externally supplied, control panel or local signals from causing the BESS to operate in an unsafe manner or in a manner that may damage the BESS.

74.2 Control Functions and Protocols

74.2.1 To the extent possible, all BESS control functions and operating modes shall be in accordance with standard functionalities for smart distributed resources, as documented in the IEC 61850-90-7.

74.2.2 The communication protocol for the BESS shall be according to IEEE 1815-2010, Standard for Electric Power Communications—Distributed Network Protocol (DNP3), as further developed in DNP3 Application Note AN2011-001, DNP3 Profile for Basic Photovoltaic Generation and Storage or IEC 61850.

74.2.3 If data points and/or control functions outside the standard point definitions in DNP3 AN2011-001/IEC 61850 are created by the Contractor, the Contractor shall maintain a systematic log of the same for the purpose of maintaining/facilitating interoperability with future standards/protocols for distributed energy resources

74.3 Additional Control System Functions

74.3.1 Shutdown/Startup/Standby

The start and stop controls shall be as per DNP3 AN2011-001 standard specifications or IEC 61850. The control system shall use these controls for an orderly and safe shutdown, even in the absence of grid power. The control system shall also use these controls for an orderly startup sequence, which shall provide for a safe system reset from any standby or operating condition so that the unit goes through a normal startup sequence in the same way it would when being powered up after loss of power or being in a shutdown state. The control system shall include provisions for a standby state (that is, BESS but not charging or discharging),

which shall be the end result of a normal startup sequence. It shall also be possible to enter the standby state from any of the other operating states except connect/disconnect.

74.3.2 Initiation of Shutdown

The control system shall initiate shutdown under the following conditions and shall remain in the shutdown state until a reset signal, either local or remote, is initiated. An appropriate alarm shall be set.

- 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 (field-adjustable setting).
- Remote disable (no reset required).
- grid system faults (balanced and unbalanced; line-to-ground, line-to-line, and three-phase).
- Abnormal frequency
- 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

74.3.3 Reset Alarms

For all system-generated alarms, the control system shall provide for the resetting of those alarms. This function is intended for alarms that, after they are set (for example, by a fault condition, as listed above and elsewhere in this specification), must be cleared by operator intervention to allow normal operation to be restored.

74.3.4 Modify Storage Settings

The control system shall provide for modification of various set points and fixed operation/control settings associated with the various control functions.

74.3.5 Event/History Logging

The control system shall provide for the automatic logging of the following information:

- All errors or failures
- All startup and shutdown actions
- All control actions
- All responses to control actions
- All limit violations, including returns within limits

74.3.6 Status Reporting

The control system shall provide for reading and reporting of various BESS- supplied status information in accordance with the data collection and reporting requirements specified in this technical specification.

74.3.7 Time Synchronization

The control system shall provide for synchronization of its real-time clock with a standard time source.

74.3.8 Change Operational Mode

The control system shall support the mechanisms inherent in DNP3 AN2011-001 for activating/deactivating control functions. The control functions are expected to be executed by command from a remote host, but may also be scheduled according to the DNP3 standard.

74.3.9 Perform Self Diagnostics

The control system shall provide for self-diagnostic functions.

74.4 Control System Hardware Requirements

All local control and monitoring system components shall be housed in appropriate controlled environment enclosures either as separate arrangement or in conjunction with Solar Plant SCADA system.

74.5 Control System Self-Protection and Self-Diagnostic Features

74.5.1 The BESS shall include appropriate self-protective and self-diagnostic features to protect itself and the battery from damage in the event of BESS component failure or from parameters beyond the BESS's safe operating range due to internal or external causes. The self-protective features shall not allow local or remote signals to cause the BESS to be operated in a manner that may be unsafe or damaging to the BESS. All protective operations resulting in a shutdown shall be carried out in an orderly and safe manner, even in the absence of utility power.

74.5.2 Temperature sensors shall be incorporated in critical components within the BESS. The BESS shall alarm and go to standby/fault mode when an over-temperature condition is detected.

74.5.3 The BESS shall alarm upon detection of a DC ground fault. The alarm trip level shall be field adjustable.

74.5.4 Door interlock switches shall be provided for all BESS container doors. The BESS shall alarm and go to shutdown mode when an BESS door is opened. Doors shall be fitted with provisions for external locks.

74.5.5 The BESS shall alarm and go to shutdown mode upon detection of smoke.

74.5.6 Surge-protection devices shall be provided at the input and output terminals of the BESS.

74.6 Control Panel

- The BESS shall include a local control panel or console, which is easily accessible, on or within the BESS container. As a minimum, the following operator controls shall be located on the control panel:
- Trip/reset for the BESS AC circuit breaker or contactor.
- Trip/reset for DC circuit breaker(s)/contactor(s).
- PCS on/off.
- Reset toggle or push button. When reset is initiated, the control system shall resume control and proceed to the appropriate operating mode.
- 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.
- The control panel or console shall also include meters, indicators, and displays.

74.7 Performance Monitoring and Data Acquisition

74.7.1 The BESS shall include a (Data Acquisition System) DAS to provide continuous monitoring and display of key operational parameters, as well as permanent archival of all measured parameters. The DAS shall include sensors, transducers, wiring, signal isolation and conditioning circuitry, and data acquisition and analysis hardware and software as required to perform the functions described in this section. The DAS shall be of standard commercial manufacture and shall use hardened components suitable for operation in the climatic conditions prevailing at site.

74.7.2 The DAS shall measure operational data, as described in this Clause, and shall record all data points to fixed and removable non-volatile memory. The DAS shall be capable of making all monitored data and events available through the DNP3 / IEC 61850 communication interface and shall permit display of current values and recent historical trends on a local

screen for all recorded points. In addition, the DAS shall provide panel meter displays of certain operational parameters, as prescribed below.

74.7.3 Provision of monitoring and event data via the communication interface shall adhere to DNP3 AN2011-001 / IEC 61850 to the extent possible and capture at least the following data points:

- Frequency at the AC bus
- AC real power
- Power factor
- Real energy delivered
- Real energy received
- Auxiliary power
- Auxiliary energy
- DC power
- DC voltage
- DC current
- Phase A voltage
- Phase A angle
- Phase B voltage
- Phase B angle
- Phase C voltage
- Phase C angle
- Battery state of charge
- Battery string currents
- Battery temperature

74.7.4 Digital displays, on the BESS Control Panel, shall be no less than 1 in. (2.54 cm) high and shall update at least once per second. The DAS shall be integrated with the Solar PV SCADA described elsewhere in this Technical Specification either as addendum or within an overall Energy Management System Interface. The DAS shall, at a minimum, provide remote data inquiry from personal computer– based platforms and data file export capabilities in ASCII format on independent media (such as a universal serial bus drive) that are readable on personal computer-based systems.

74.7.5 The DAS shall continuously measure or calculate the data points identified in 74.7.2 and shall make them available via the communication network as specified. All measured parameters shall also be permanently archived in all modes of operation. For continuously varying quantities, the Contractor shall propose for Employer's review and approval an approach to data archiving that is suitable for each quantity measured. The final approach will be decided

during product design.

74.7.6 The DAS shall provide unsolicited message capability for reporting critical alarms. The Contractor and the Employer will agree on a list of alarms that are reported the instant they are detected. However, a minimum of following parameters shall be displayed on BESS local control panel, console, or SCADA computer:

- Main temperature Alarm (on system temperature exceeding a predetermined threshold)
- Smoke/fire Alarm (on system detection of smoke/fire)
- DC leakage current (battery leakage current to ground exceeding a predetermined threshold)
- Breaker status (connect/disconnect switch)
- AC voltage OK (system ac voltage exceeding a predetermined threshold)
- Battery temperature alarm (battery temperature exceeding a predetermined threshold)
- Synchronization error shutdown
- PCS fault
- Weak Unit Battery Alarm
- AC system fault
- Control logic problem (problem with the BESS control logic)
- DC fuse blown
- Container door open (BESS container door opening)

74.7.7 The BESS shall include provisions for determining and storing in non-volatile memory the sequence of abnormal events, trips, and/or alarms that cause the BESS to go the disconnect or shutdown state. It is preferable that this function be implemented separately from the normal operations data acquisition function of the DAS so that failures in the latter (hardware/software failures or power interruptions) will not prevent the permanent logging of abnormal event sequences. The BESS shall include provisions to transmit, at a minimum, the data displayed on the panel meters and the alarm/status indicators to the remote computer.

75 Grounding

A suitable equipment grounding system shall be designed and installed for the BESS. This system shall be designed to be tied to an existing site grounding system. The system also shall be adequate for the detection and clearing of ground faults.

All exposed non-current-carrying metal parts shall be solidly grounded. Particular attention shall be given to prevention of corrosion at the connection of dissimilar materials such as

aluminium and steel.

76 Wiring

76.1 All wiring shall be continuous for each wiring run; splices are not acceptable.

76.2 Wiring that may be exposed to mechanical damage shall be placed in conduit or armoured.

76.3 Wires shall have identifying labels or markings on both ends. The labels or markings shall be permanent and durable. Stick-on labels will not be allowed. All field wiring between separate equipment items supplied by the Contractor shall be color-coded according to appropriate standards.

76.4 In general and where practicable, 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 within a common enclosure.

76.5 BESS and PCS control and instrumentation system wiring shall be bundled, laced, and otherwise laid in an orderly manner. Wires shall be of sufficient length to preclude mechanical stress on terminals. Wiring around hinged panels or doors shall be extra flexible and shall include loops to prevent mechanical stress or fatigue on the wires.

76.6 Insulation and jackets shall be flame retardant and self-extinguishing.

76.7 Wiring to terminal blocks shall be arranged as marked on wiring diagrams. Terminal groupings shall be in accordance with external circuit requirements.

76.8 Raceway and cable systems shall not block access to equipment by personnel. There shall be no exposed current-carrying or voltage-bearing parts.

77 Civil/Structural

77.1 General Requirements

77.1.1 Soil bearing stresses shall not exceed the allowable stresses for the soil parameters, as determined by the Contractor. A minimum safety factor of 1.5 shall be provided against uplift, sliding, and overturning loads. Soil stresses shall be calculated using unfactored loads.

77.1.2 All structures and foundation designs must include suitable evidence to show that their design is commensurate with a minimum of 25-year life.

77.1.3 Unless specifically stated otherwise, the design of all structures, equipment, and foundations shall be based on applicable portions of IS codes, these specifications, and industry standards.

77.1.4 All components shall be painted, coated, or otherwise protected in a manner commensurate with at least 25-year design life. Particular attention shall be given to prevention of corrosion at the connections between dissimilar materials such as aluminium and steel, and steel and concrete.

77.1.5 All structures and foundations shall be designed to resist dead, live, wind, and seismic loads.

77.2 Requirements for Contractor Installation

77.2.1 The Contractor shall be responsible for obtaining all required permits and ensuring that all inspections by local authorities are completed as required.

77.2.2 Calculations based on applicable standards shall be supplied to show that the design of the entire BESS will withstand wind speed and/or gusts and other loads specific to the site and that the design meets all applicable structural and transportation codes.

77.2.3 Excavation spoils shall be disposed of as directed by the Employer.

77.2.4 All reinforced concrete work shall be in accordance with relevant Indian Standards. All other materials and installation requirements shall be subject to Employer approval.

78 Mechanical

78.1 All exposed surfaces of ferrous parts shall be thoroughly cleaned, primed, and painted or otherwise suitably protected to survive outdoor conditions for at least 25-year design life of the system.

78.2 Outdoor enclosures shall be weatherproof and capable of surviving intact under the site environmental conditions specified. Outdoor enclosures shall be equipped to prevent condensation.

78.3 Components mounted inside enclosures shall be clearly identified with suitable permanent designations that also shall serve to identify the items on drawings provided.

78.4 The site temperatures and the effect of temperature on component life shall be considered in developing the thermal design for all components, including the battery and PCS. Irrespective of the heat-removal system design the final rejection of all waste heat from the BESS shall be to the ambient air. Air-handling systems shall include filters to prevent dust intrusion into the BESS.

78.5 The BESS shall include an HVAC or ventilation system designed to maintain battery temperatures at levels acceptable to the Contractor's normal battery warranty conditions, conducive to acceptable battery life, and as required to maintain battery capacity for all seasons/climatic conditions at the site. The air handling/distribution system shall be designed to promote temperature uniformity within the battery.

79 Other Design Requirements

79.1 Noise Levels

The Contractor shall provide for and maintain noise mitigation devices like Noise mufflers at site, if required.

79.2 Fire Protection

The Contractor shall design and install a fire protection system that conforms to good engineering practice. The fire protection system design and associated alarms shall take into account that the BESS will be unattended. If required by the type of fire protection system provided, the Contractor shall calculate and take into account the heat content of the battery cell materials in designing an appropriate fire protection system. Separate fire protection systems may be used in the battery, PCS, and control areas.

79.3 Toxic Materials

If any toxic substance can be emitted from the equipment during a failure, fire, or emergency or protective operation, description of the toxic nature of the substances as well as treatment for exposure to it shall be included in the O&M manual. Their treatment and disposal shall be in accordance with the New Hazardous Waste Management Rules 2016 notified by the Government of India.

79.4 Spare Parts and Equipment

The Contractor shall evaluate the design with regard to expected failure rates, modes, and effects; overall BESS reliability; and planned mode of servicing. Based on this evaluation, the Contractor shall recommend and furnish an initial complement of spare parts that are not readily available. For example, these spare parts may include spare unit batteries and a small rectifier to maintain the unit batteries, as well as fuses, printed circuit boards, and switching devices (gate turnoff thyristors [GTOs], silicon-controlled rectifiers [SCRs], insulated gate bipolar transistors [IGBTs], and so on).

80 Maintenance and Repair

80.1 The Contractor shall supply all labour, equipment, and materials needed to maintain the BESS performance and safe operation, including all maintenance required to satisfy the warranty terms and conditions.

80.2 The Contractor shall list all maintenance activities to be carried out under the maintenance contract. For each maintenance item, the list shall include a description of the item, the expected frequency (maintenance interval), the time required to perform the maintenance, any anticipated parts replacement, and any potential problems in carrying out the maintenance.

81 Factory Acceptance Testing of BESS

81.1 The Contractor shall develop and submit to the Employer for its review and approval a comprehensive FAT plan that shall demonstrate that the BESS will meet the requirements of the specification. The Employer shall have the right to request reasonable changes to the test plan.

81.2 Where full-scale testing of larger systems at the factory may be difficult or impossible due to the large system, the FAT shall be carried out at a subsystem or module level and shall consist of tests of 100% of the subsystems or modules that comprise the complete BESS, to the extent possible. In the FAT plan, the Contractor shall clearly state what is being tested and shall fully explain any features or functions of the fully assembled BESS that would not be fully tested in the reduced-scale testing proposed. In such a case, the SAT plan shall further describe how the tests that could not be carried out in the factory will instead be carried out at the site.

81.3 After the Contractor determines that the BESS is fully operational, the Contractor shall conduct a FAT, witnessed by the Employer and/or the Employer's representative. The FAT shall consist of the Contractor demonstrating to the Employer that the BESS is fully operational and performs as specified. This includes but is not limited to the following:

- Visual inspection of all provided equipment, including dimensions and overall design.
- Verification of proper mechanical construction such as electrical connection torques.
- Verification of sensors, metering, and alarms.
- Verification of all control functions, including remote control and monitoring, and communications interfaces.
- Verification of BESS performance at full and partial power and energy ratings.
- Verification of maintenance and replacement features for unit batteries and other key components.
- Verification of compliance with specifications.

81.4 During the FAT, the BESS shall meet the following:

- Be operated and function as specified and designed in all the operating states, use cases, and duty cycles specified herein
- Meet the power and energy requirements specified herein
- Be demonstrated to meet the safety and response to catastrophic failure requirements specified herein
- Have the efficiencies, response capabilities, and other features specified herein and/or proposed by the Contractor

Note: *The methodology for measurement of procurement specifications is provided in the Annexure-E to this Section.*

81.5 Operation of all control, protective relaying, and instrumentation circuits shall be demonstrated by direct test, if feasible, or by simulating operating states for all parameters that cannot be directly tested. Automatic, local (control console), and remote operation of the controls shall be demonstrated.

81.6 Factory testing shall demonstrate operation at expected temperature extremes at the

Employer's site. If this is not possible for the full BESS at the manufacturing facility, independent laboratory certification of operation of critical components and subsystems in the battery, PCS, and control systems shall be submitted at the time of the FAT. The Contractor shall submit to the Employer for approval, 90 days before the FAT, a list of components and subsystems for which independent lab testing certification will be sought.

81.7 The Contractor shall perform any and all system modifications required during start-up and testing. The testing may be suspended as a result of a BESS malfunction and resumed only on rectification of problem items. Such suspension and resumption will occur at the sole discretion of the Employer.

81.8 The BESS will not be accepted for shipment until all FATs have been successfully completed. In addition, the Employer will verify that all provisions of the contract have been met, including verification of all required submittals, any spare parts delivery, and any required system modifications.

82 Commissioning and Functional Guarantee test procedure

82.1 The Contractor shall develop and submit to the Employer for its review and approval a comprehensive SAT plan that shall demonstrate to the Employer that the BESS will perform as specified at the Employer's site. The Employer shall have the right to request reasonable changes to the test plan.

82.2 The Contractor shall develop and perform SAT procedures to ensure that the BESS will perform as designed and that the system meets the performance criteria specified elsewhere in these specifications. The SAT plan shall include procedures to test operating scenarios described in the specification. These procedures may involve special requirements and/or witnessing by the local independent system operator. To the extent achievable, all use cases and operating modes described in the specification shall be tested.

82.3 After the Contractor has determined that the BESS is fully operational, the Contractor shall conduct the SAT, witnessed by the Employer and/or the Employer's representative. The tests shall include, as a minimum, the following:

- Verification of sensors, metering, and alarms
- Verification of all control functions, including automatic, local, and remote control
- Verification that the performance criteria in the specification can be met or exceeded
- Demonstration of all of the intended uses
- Demonstration of interface protection circuits and functions and control interfaces

82.4 Tests shall demonstrate that the BESS capabilities, efficiencies, response, and features are as proposed by the Contractor.

82.5 Testing shall include, as a minimum, measurement of harmonic content and power factor at

full and partial power levels for both charge and discharge.

82.6 Operation of all control, protective relaying, and instrumentation circuits shall be demonstrated by direct test, if feasible, or by simulating operating states for all parameters that cannot be directly tested. Automatic, local, and remote operation shall be demonstrated.

82.7 The SAT shall also specifically address discovery of problems or failures that may have occurred during or as a result of shipment.

82.8 The Contractor shall perform any required modifications and repairs identified by the testing, before acceptance by the Employer.

82.9 The Employer will not accept the BESS for commissioning until all acceptance tests have been successfully completed and all provisions of the contract have been met.

82.10 Functional Guarantee - Actual Operating Experience

Since it may not be possible, due to system constraints, to test all facets of the BESS function as part of the performance verification tests specified in the preceding sections the actual operating experience of the BESS during the performance guarantee period after initial startup shall be deemed an extension of the performance verification tests. The performance guarantee period shall not be construed as a substitute for the warranty requirements, as specified in the subsequent Clause. Actual operating experience will be documented through Contractor-furnished records, and other system monitoring equipment and associated BESS performance. Documented failure or malfunctions of any BESS component during the performance guarantee period shall be deemed a failure of the system commissioning test. The Contractor shall, at no cost to the Employer, make the necessary repairs, replacements, modifications, or adjustments to prevent the same failure or malfunction from occurring again. The replacement of certain BESS components in response to a system failure may necessitate, at the discretion of the Employer, the duplication of certain performance verification tests, which shall be performed at the Contractor's expense.

83 Warranty

83.1 The Contractor shall provide a warranty for the entire BESS and its constituent equipment.

83.2 At a minimum, the Contractor shall provide an unconditional, 5 (five) -year parts and labour warranty on all BESS equipment except battery (unit or racks). For the battery storage, the warranty shall cover parts warranty including battery nominal capacity ratings in order to meet the End of battery Life condition described in this specification.

83.3 Warranty replacement shall be required for individual unit batteries that degrade in performance to the point at which the BESS cannot meet the requirements specified in this specification up to the End of Battery Life and/or for unit batteries that materially degrade the

availability, reliability, safety, or functionality of the BESS.

83.4 The warranty shall guarantee the availability of battery replacements delivered to the site within 2 weeks of notification during the battery warranty period. This period, shall, however, not be considered part of the Accountable Outage period for assessing BESS availability.

83.5 Additional warranty requirements are as follows:

- The warranty shall specify the terms and conditions of the warranty, including operating conditions requirements, procedures that must be followed, and all maintenance requirements. The warranty terms shall be easy to understand and shall be clearly stated.
- The warranty shall provide an explicit statement as to the warranted cycle life and the warranted calendar life of the battery.
- The warranty shall include a simple and easy to understand proration formula, if any, to be used in crediting the Employer for unused life or capacity of equipment replaced or repaired.
- The warranty shall specify guaranteed battery replacement costs. The Employer shall be provided the option to secure the guaranteed replacement cost at the time of the initial supply agreement.
- The warranty shall specify the scope of service associated with software updates.
- The warranty shall specify the scope of service included in replacement or repair of the equipment.
- The warranty shall specify all labour, materials, shipping charges, and other Employer expenses not included in the warranty.
- The warranty shall specify the estimated time to complete the repairs/replacement required to restore the BESS to the warranted performance level. The time shall be given as the number of working days from the time of Employer's notice to the Contractor that the BESS has failed to meet the performance requirements.

84 Documentation and Submittals

84.1 The Contractor shall furnish complete documentation that will be used for determination of contract compliance, as well as O&M of the BESS.

84.2 Review and acceptance of submittals shall not encumber the Employer or the Host Utility with responsibility for the adequacy or safety of the Contractor's design.

84.3 Titles shall clearly indicate the function of the document, the Employer and location of the facility.

84.4 At a minimum, Contractor's documentation shall consist of the following:

- Construction and installation drawings
- Construction materials submittal
- Equipment drawings and specifications
- Operation and maintenance manual
- Maintenance schedule
- Critical path method project schedule
- Master test plan and procedures
- Quality assurance manual
- Software documentation
- Study reports
- Test reports
- Training manuals

Annexure-A: Site Details

1. **Site Location:**
   i. The proposed power project shall be located at Rangreek near the 2 MW Rong Tong Hydroelectric Power station in Lahaul Spiti District of the State of Himachal Pradesh.
   ii. The site is located at Latitude 32°14'27.46"N and Longitude 78° 2'25.47"E.
   iii. The nearest urban area from the site is Kaza Town.

2. **Access to Site:** Kaza is located high up in the mountains of the Lahaul and Spiti valley in the north Indian state of Himachal Pradesh. It does not have an airport but is connected by road to major cities of Himachal. Provided below are some options to reach Kaza:

   By Air

   Kaza can be reached either from Manali or via Shimla. Indian Airlines and some private airlines operate regular flights to Bhuntar Airport, the nearest airport to Manali. Pre-paid taxis are available from Bhuntar airport. Buses and taxis can be hired from Manali to Kaza. Flights from New Delhi and Chandigarh operate on a daily basis to Shimla airport.

   By Train

   Jogindernagar is the nearest railway station. The rail route from Jogindernagar to Chandigarh is a narrow gauge one. Shimla and Chandigarh are the nearest broad gauge railway stations. Buses and taxis are available from Shimla and Chandigarh to reach Kaza.

   By Road

   It is a 115 km journey from Manali which takes six hours. Another option is to take bus from Shimla via Kinnaur to Kaza. The route from Shimla to Kaza remains open from May to October and is about 412 km long.

3. **Land**

   i. The project site is roughly rectangular in shape with total area of approximately 5.59 hectares and total perimeter approx. 1850 m. An outline of the same has been provided below.

ii. The land for the proposed Project is presently Govt. Forest land that shall be transferred to HPSEBL and access rights shall be given to the Contractor for the purpose of execution of the Contract.

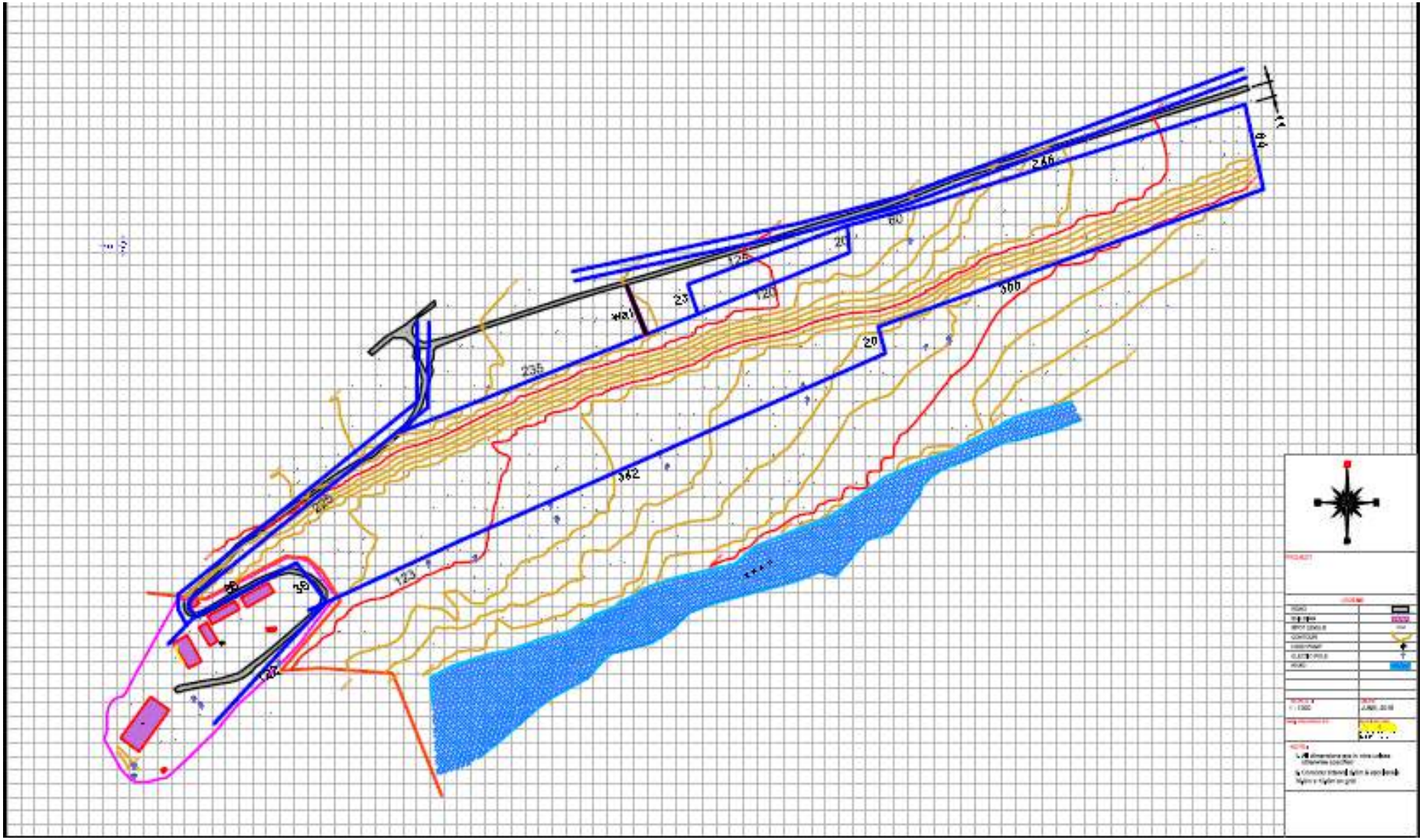
iii. Preliminary Topographical Survey of the proposed site has been carried out and the CAD file shall be provided to the bidder. However, geotechnical investigation and soil survey etc. has to be carried out by the agency i.e., the Contractor.

iv. The scope of works shall also include making necessary approaches and measures to minimize soiling

v. The developer has to carry out soil investigation through any Govt. Approved laboratory for designing of the civil foundations, structures, control room building, invertor building etc.

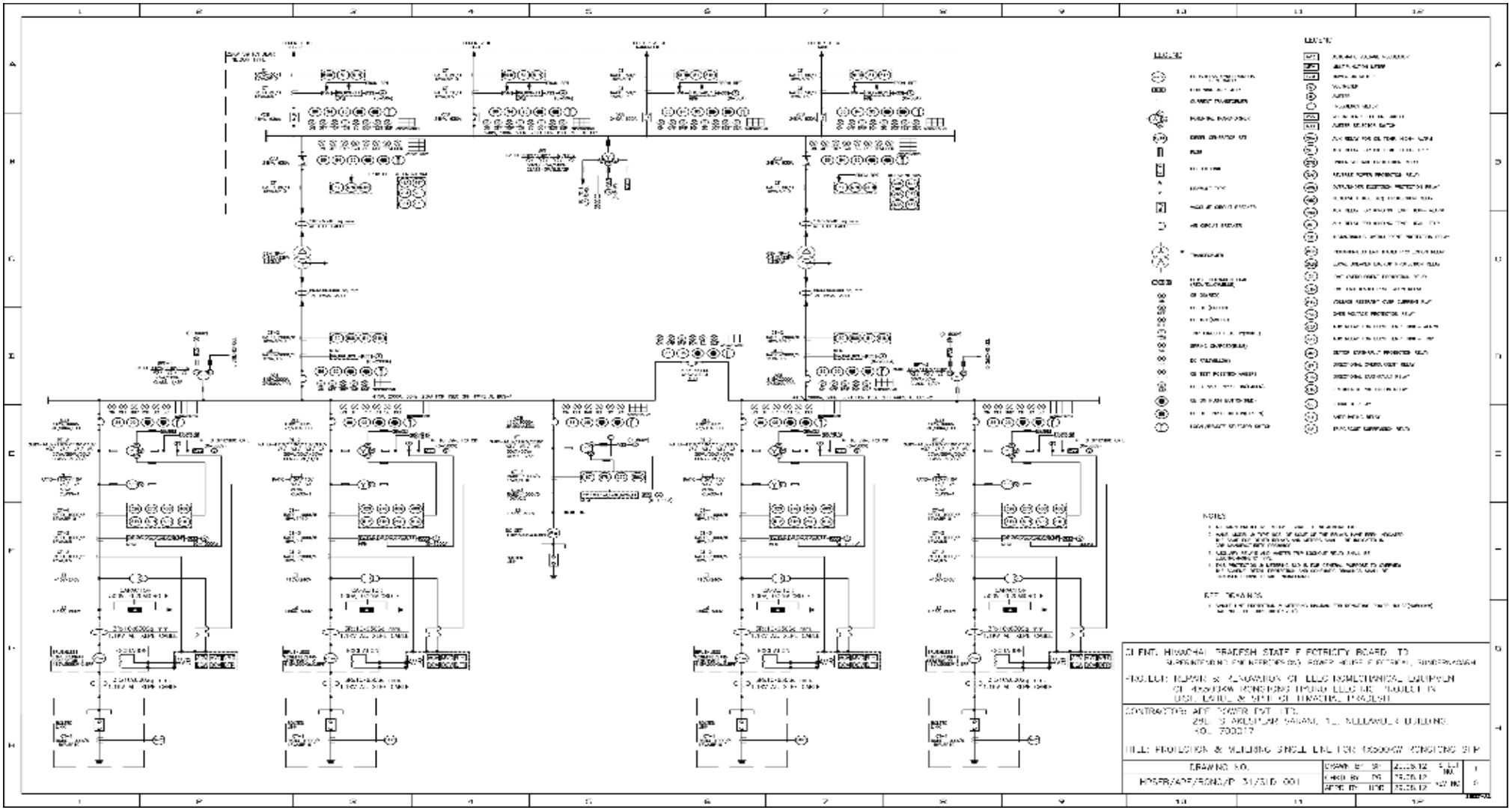
4. Interconnection

At Rongtong power house both the buses at 415KV and 22KV are placed indoor along with all the CBs, CTs, PTs. The power transformers are also stationed indoor. Only, isolator, earth switches and LAs are provided at the switchyard. The Rongtong Power House is located about 200m from the proposed Solar & Wind plant. It is desired that all the power cables coming out of Solar PV plant, Wind Electric Generators and ESS may be terminated at local Busbar at a common voltage level and only a single 22KV cable circuit to be taken to the switchyard at Rongtong Power House. At Rongtong HEP there is sufficient space to place only one or two panels for 22KV CB, CT & PT. It will be in the contractor's scope to provide all these along with cable terminations at switchyard through isolator, earth-switch and LA.



2 MW Grid Connected Solar PV Power Plant with BESS at Rangreek, HP	SITE DETAILS	Page 4 of 5	Signature of Bidder

Figure 1: SLD of 22 kV Substation at Rangreek



Annexure – A

Pre-dispatch Inspection Protocol for Crystalline PV Modules by Employer or Employer Deputed Agency

On behalf of

Himachal Renewable Limited

By:

SOLAR ENERGY CORPORATION OF INDIA LIMITED

(A Government of India Enterprise)

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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. Standard:

Sampling for determining Acceptance Quality Level (AQL) shall follow ISO2859-1:1999.

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.

The details of materials used will be verified from the ERP/Manufacturing data and corroborated with the Construction Data Form (CDF). This shall include verification of following:

Item	Method of Verification
Shelf life of the following BOM items: • EVA • PV Module Back sheet • Sealant and potting material (Silicone)	1. Verify the expiry date/shelf life and storage conditions *The PV Module manufacturer shall submit all required information to prove that materials being used are within their shelf life.*

Note: 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

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-II. 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 ±2ºC
- Calibration of Sun-simulator: Sun-simulator will be calibrated as per Calibration Reference .Reference should calibrated against Calibration Reference tested from reputed testing lab TUV / Fraunhofer etc. Testing of modules will be done at STC condition, AM=1.5

Note:

i All modules selected for sampling inspection will be re-tested in the sun-simulator. A P_{max} retest (repeatability test) variation of ± 2 % on actual flash P_{max} value will be acceptable.

ii The Supplier shall provide a valid calibration certificate of the apparatus used.

b. Visual Inspection:

- Customer representative will verify the module visual characteristics as per the Visual Acceptance norms.
- The Visual Inspection shall be carried out in a well-lit room. It shall be the responsibility of the Supplier to ensure adequate brightness in the room.

c. Electroluminescence (EL) Inspection:

- The EL image shall have sufficient resolution for analysis of defects.

- Hi-pot test shall be done as per IEC procedure. The Supplier shall provide a valid calibration certificate of the apparatus used.

9. Re-inspection and review

In case of minor non-conformities like cleaning issues, label mismatch, etc. which can be easily reworked, Supplier shall rework/replace the modules and offer them for re-inspection to Inspector.

10. Inspection Summary:

Once the inspection is completed Customer Representative will compile his Inspection Summary Report and share with Supplier and give necessary recommendation on despatch depending upon the audit findings based on the observations made. This report shall be provided within same day of inspection (Format Attached).

11. Disclaimer:

Inspection by 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.

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

(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 | Sample size | Acceptance quality limit, AQL, in percent nonconforming items and nonconformities per 100 items (normal inspection) | | |

Table 2-B — Single sampling plans for tightened inspection (Master table)

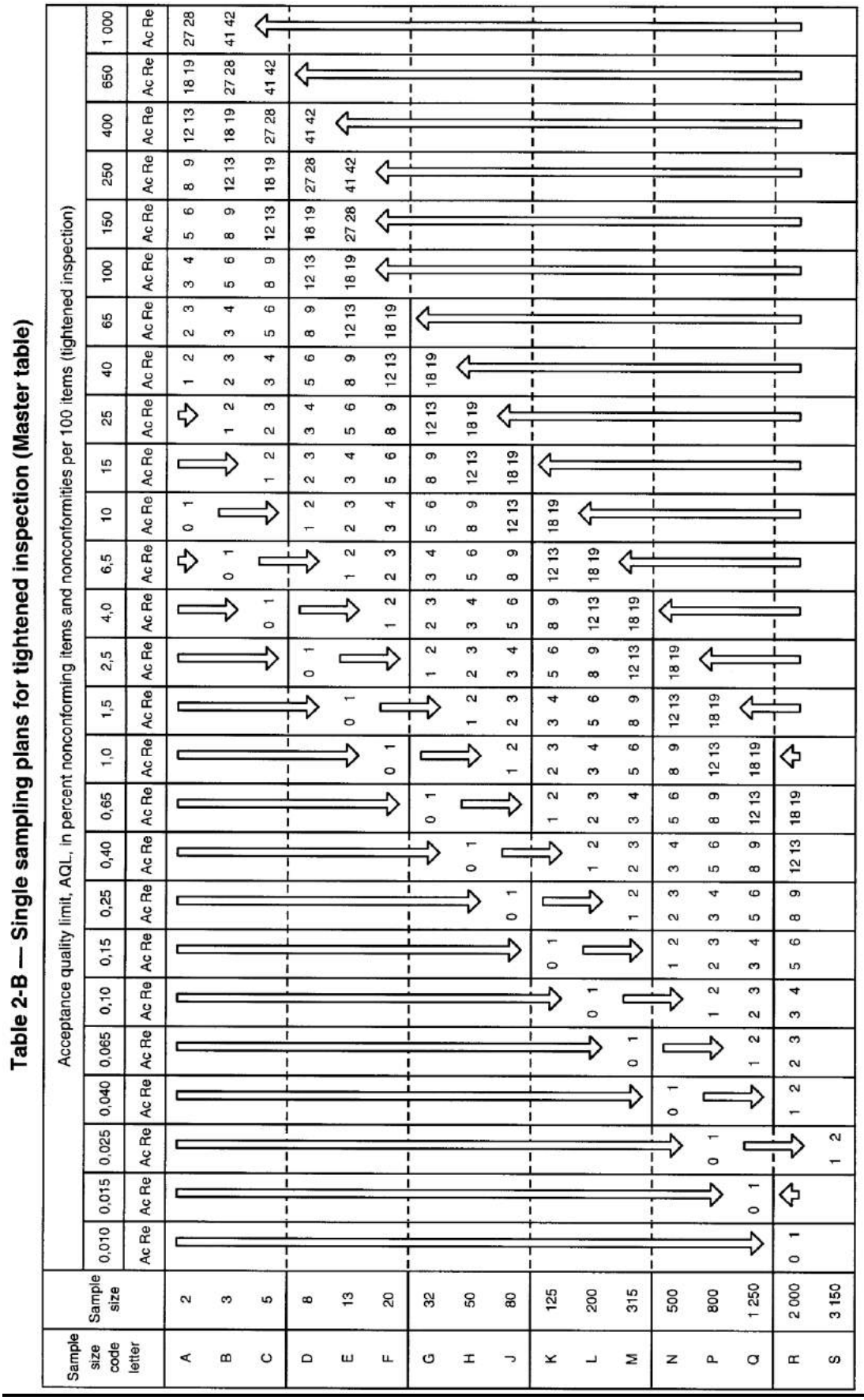

Table 2-C — Single sampling plans for reduced inspection (Master table)

Sample size code letter	Sample size	Acceptance quality limit, AQL, in percent nonconforming items and nonconformities per 100 items (reduced inspection)																												
		0,010	0,015	0,025	0,040	0,065	0,10	0,15	0,25	0,40	0,65	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	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re
A	2	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	0 1	⇩	⇩	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	30 31
B	2	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	0 1	⇧	⇩	⇩	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	30 31
C	2	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	0 1	⇧	⇩	⇩	1 2	2 3	3 4	5 6	6 7	8 9	10 11	14 15	21 22	⇩	⇩
D	3	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	0 1	⇧	⇩	⇩	1 2	2 3	3 4	5 6	6 7	8 9	10 11	14 15	21 22	⇩	⇩	⇩
E	5	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	0 1	⇧	⇩	⇩	1 2	2 3	3 4	5 6	6 7	8 9	10 11	14 15	21 22	⇩	⇩	⇩	⇩
F	8	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	0 1	⇧	⇩	⇩	1 2	2 3	3 4	5 6	6 7	8 9	10 11	⇩	⇩	⇩	⇩	⇩	⇩	⇩
G	13	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	0 1	⇧	⇩	⇩	1 2	2 3	3 4	5 6	6 7	8 9	10 11	⇧	⇩	⇩	⇩	⇩	⇩	⇩	⇩
H	20	⇩	⇩	⇩	⇩	⇩	⇩	⇩	0 1	⇧	⇩	⇩	1 2	2 3	3 4	5 6	6 7	8 9	10 11	⇧	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩
J	32	⇩	⇩	⇩	⇩	⇩	⇩	0 1	⇧	⇩	⇩	1 2	2 3	3 4	5 6	6 7	8 9	10 11	⇧	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩
K	50	⇩	⇩	⇩	⇩	⇩	0 1	⇧	⇩	⇩	1 2	2 3	3 4	5 6	6 7	8 9	10 11	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩
L	80	⇩	⇩	⇩	⇩	0 1	⇧	⇩	⇩	1 2	2 3	3 4	5 6	6 7	8 9	10 11	⇧	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩
M	125	⇩	⇩	⇩	0 1	⇧	⇩	⇩	1 2	2 3	3 4	5 6	6 7	8 9	10 11	⇧	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩
N	200	⇩	⇩	0 1	⇧	⇩	⇩	1 2	2 3	3 4	5 6	6 7	8 9	10 11	⇧	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩
P	315	⇩	0 1	⇧	⇩	⇩	1 2	2 3	3 4	5 6	6 7	8 9	10 11	⇧	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩	⇩
Q	500	0 1	⇧	⇧	⇩	1 2	2 3	3 4	5 6	6 7	8 9	10 11	⇧	⇧	⇧	⇧	⇧	⇧	⇧	⇧	⇧	⇧	⇧	⇧	⇧	⇧	⇧	⇧
R	800	⇧	⇧	⇧	1 2	2 3	3 4	5 6	6 7	8 9	10 11	⇧	⇧	⇧	⇧	⇧	⇧	⇧	⇧	⇧	⇧	⇧	⇧	⇧	⇧	⇧	⇧	⇧

⇩ = 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

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:** **Inspection Result (OK/Not OK):**			
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? ☐ ☐ **Yes** **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				
….				

	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 issentially 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 storrage 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)*											

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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											
25	iii	Crushing Value, Impact value, Abrasion value		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
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 Mosture 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											
33	ii	Specific Gravity and density (for design mix concretes only)	As per IS: 2386, 383	Major	Visual	One test at Lab for each source/ on every change of source							
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.
38	ii	Physical & Chemical properties			Review of MTC		IS: 9103, Manufacturer's Brochure						Each lot/ batch of admixurture shall acompany the Manufacturer's Brochure and shall be correlated with MTC
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			Visual								
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 specifed 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											
53	v	Percentage Elongation							√	**x**	**x**	**x**	
54	vi	Bend/Rebend Test											
55	vii	Reverse Bend Test for HDS wire					IS:432, Tec. Specs		√	**x**	**x**	**x**	
57	**3**	**Structural Steel Work {Example: Chequered plate cover, Panel supports, Rungs, Cat lader, 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 quanity at Random			√	**x**	**x**	**x**	For Fencing gate - dimensional check 100%

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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**	
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										
71	v	GL, Pile depth, diameter and alignment	As required		Measurement								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
72	vi	Cleaning/ flushing of pile bore	As required	Major	Visual								
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		IS 2911, Tech Specs, Construction Drawings	SR	√	**x**	**x**	**x**	
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		Ctitical	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, suplphate 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/ Batcher 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, finsishing after removal of shuttering	As required & dimensional tolerences	Major	Visual/ Measurement	At Random			√	**x**	**x**	**x**	

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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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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 Distemeper, 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 & Alied 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 agrregates/ 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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171	a	Material - Glazed ceramic Tiles, Vitrified Ceramic Tiles, Mosaic Tailes, 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 aplicable)		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 aplicable)											
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 aplicable)											
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 catelogue	SR	√	x	x	x	In case of ready mixed grout MTC to be correlated with Manufacturerr's catelogue
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	!00% 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, Reviewof 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 Cosnstruction 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	Polyurethene based coating, polyester scrim cloth, extruded HD dimpled polyurethene	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	Elastomaric 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	Sanitory 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 sanitory 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	
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	Agrregate 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 200cun 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	Initialy 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	Initialy 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	Initialy 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	Initialy 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	Initialy 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	Submittion 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	Submittion 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 pillers 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 andAproved 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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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**	
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 thereoff/ 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 thereoff	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 measureemnt
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**											

	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 issentially 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**	
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 50^0 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 - 440^0 C to 460^0 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/ Measureemnt	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 tolerence through in postion ispection 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%	Aprroved drawing/ marking scheme	IR	√	x	x	x	Record review Random sample shall be checked during facroty visit by Vendor and SECI/ Owner representative

	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 issentially 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**	
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 readyness - 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													
588													
589													
590													
591													

	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 issentially 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**	
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										

Annexure – B

PG Test Procedure

SOLAR ENERGY CORPORATION OF INDIA LIMITED

(A Government of India Enterprise)

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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) Annual Generation Guarantee up to a period of 5 years (O&M Period), starting from the date of 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 2.4. 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 Ed.2).

$$PR = \frac{E_{out}}{\sum_k \left(\frac{(C_k \times P_o) \times (G_{i,k} \times \tau_k)}{G_{i,ref}} \right)}$$

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 $Ck = 1 + \gamma \times (T_{avg_mod,k} - T_{ref})$
γ	Temperature coefficient of power with negative sign ($°C^{-1}$)
$T_{avg_mod,k}$	Average PV Module temperature measured at the commencement of time interval 'τ_k' (°C)
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)

$G_{i,ref}$ 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 consecutive 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 at the plant end 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***.
- All the end of each day, 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 continue for 30 consecutive days.**
- The Functional Guarantee condition for the purpose of Provisional Acceptance of Part 1 of the Plant Facilities shall be considered to have been met if the guaranteed Performance Ratio (PR) is achieved on a daily basis for 30 consecutive days.
- 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.

2.1.3 Pre-PR Test

2.1.3.1 The EPC Contractor shall perform start-up tests after successful completion of visual inspection and functional testing. Such testing shall be conducted under the SECI's / Owner's Engineers supervision. The test results shall be recorded as part of a signed-off commissioning record.

2.1.3.2 Preliminary Test Check

The preliminary checks include all the warranty certificates for the major equipment, pre – commissioning test reports, field quality checklists verified through the FQP documents of all equipment and works along with the calibration reports of all the instruments and sensors, wherever applicable.

2.1.3.3 Visual /Mechanical Test

Visual checks shall be done on all the components that form part of the plant including the grid

connection equipment in compliance with the field quality plans. The following critical elements as a minimum shall be subjected to visual inspection:

- Module mounting structure and foundations.
- PV module and DC installation.
- Inverters.
- Transformers.
- Switchgear.
- Lightning protection systems.
- Earthing protection systems.
- Electrical protection systems, junction boxes and cabling.
- Grid connection compliance protection and disconnection systems.
- Monitoring systems (including meteorological sensors).

2.1.3.4 Electrical Tests

Subsequent to mechanical completion and visual testing of the plants, following functional electrical tests shall be performed. These tests also referred as start-ups tests shall be the first step for PG guarantee of the plant. These tests shall essentially include:

2.1.3.5 Open circuit voltage (V_{OC}) test.

This test verifies that strings are properly connected (module and string polarity) and that all modules are producing the expected voltage according to the module data sheet. To measure Voc, the following procedure shall be used:

(a) DC string combiner box is opened; fuses leading to the sub main junction box are removed.
(b) The voltage is measured with a calibrated, industry accepted instrument from the negative bus bar to the string positive lead.

2.1.3.6 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 only) 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 achieved visual/mechanical/Electrical completion as per Clause 2.3 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 & Cleanness: 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 of all the Pyranometers (GTI) shall be considered for the calculation of PR. The average of module temperatures recorded by all the temperature 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 (consecutive) 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)
- Other Met Data received from installed WMS; (Source: SCADA, Temporal Resolution: 1 minute)
- Energy generated at Plant (kWh) (Source: Plant MFM Meter from SCADA, Temporal Resolution: 1 minute)
- Energy injected into grid (kWh) (Source: Plant ABT Meter at GSS/injection point, 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 including required 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.
- 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 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/m^2
- 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 0) for the 30-day duration. If the EPC Contractor is not able to demonstrate guaranteed PR during this period, the 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 for more than 7 days.

- Power 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 dd/mm/yyyy hh:mm:ss format	Wind Speed (m/s)	Module Temp. (°C)	Ambient Temp. (°C)	Horizontal Irradiance (W/m²)	POA Irradiance (W/m²)	POA Radiation (kWh/m²)	Humidity (%)	Wind Direction (°)	Generation (kWh) (Source: TVM)

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/m²)	POA Irradiance (W/m²)	POA Radiation (kWh/m²)	Humidity (%)	Wind Direction (°)	Generation (kWh) (Source: TVM)	Explicit Removal Flag* (0 or1)	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 0. The Report shall contain the signature of both representatives (SECI/Employer & EPC Contractor).

2.2 CAPACITY UTILIZATION FACTOR

Capacity Utilization Factor for Solar Plant shall be calculated as per the following formula.

$$\mathbf{CUF} = \frac{\mathbf{E_{ac}}}{\mathbf{8760 \times P_{ac} \times (1 - DF \times N)}}$$

where,

Eac is the number of units recorded in the plant end ABT meter, 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

CUF shall be calculated on annual basis from the date of operational acceptance of the plant till the end of O&M period.

It is the responsibility of the Contractor to build-in the expected variation of irradiance in their design by installing additional DC capacity to meet the committed CUF. Irradiance variation will not be considered for the calculation of CUF.

Grid outage hours shall be subtracted from total number of hours in a year. The Contractor shall submit

grid outage certification from component authority of STU/DISCOM.

Reports

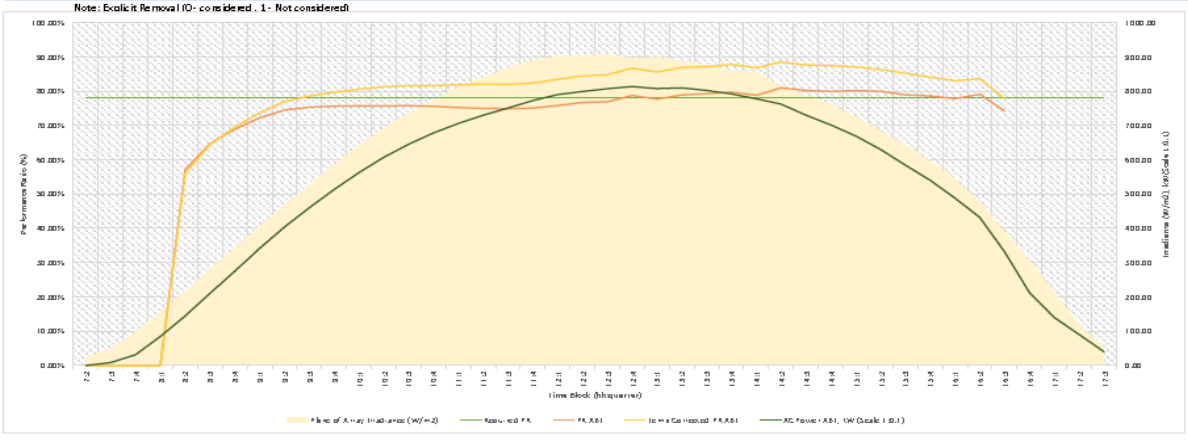
Sample Report for PR Test

PR Guarantee Test Report

Day	20-Nov-2016	Criteria	>200	Average POA Irradiance in a time block in W/m2	
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/m2 and not explicitly removed			
	(Guaranteed PR: 78%)				

Time Block (hh:Qtr)	Wind Speed (m/s)	Module Temp. (°C)	Ambient Temp. (°C)	POA Radiation (kWh/m2)	Plane of Array Irradiance (W/m2)	GHI (W/m²)	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	1.18	44.44	25.53	194.12	775.43	576.53	29.87	12.76	1695.00	678.00	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	48.61	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	48.58	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	48.79	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	48.66	29.92	223.65	895.29	671.87	20.71	96.20	2034.00	813.60	78.74%	86.70%	0
13:1	2.10	48.70	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	48.80	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	48.39	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	78.62%	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	96.68	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	306.83	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	57.78%	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]

Annexure E

Service Performance Assessment

1. System rating

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.

Measurement

The BESS 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.

** 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. Also during annual verification, the BESS Energy capacity shall not be less than 80% of the rated capacity.

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:

$$\eta_p = \frac{\sum Eo}{\sum Ei}$$

where,

∑Ei is the sum of Energy input to the BESS over n cycles

∑Eo 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)

Eo and Ei 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 on a single day. 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 (T_0) and the instant when the BESS starts responding to the discharge command signal (T_1), the BESS being in active standby state and 50% SOC at T_0 i.e., T_1- T_0

2-> Time elapsed in seconds between the instant the ESS output transitions from no discharge i.e. 0% (T_1) to discharge and the instant it attains rated power capacity(T_2) (or from no charge (T_1) to charge state and the instant it attains rated charge rate(T_2)) i.e. T_2- T_1

$$\mathbf{RT} = (T_2 - T_1) + (T_1 - T_0) = \mathbf{T_2 - T_0}$$

Where T_0 , T_1 and T_2 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

SECTION - VIII

SCHEDULE OF RATES (SOR)

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. For any deviation to the SOR format, bid is liable for rejection.

5. Bidder to note that breakup of Lumpsum price is to be provided for assessment of Total Evaluated Bid Value (TEBV), 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 Executing Agency/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 (as per Clauses of GCC) 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 are 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 5 years period.

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.

d) Bidder to mention the NPV of O&M amount for total 5 years in CELL NO I 22 of SOR-1 which should match with the NPV of O&M amount for total 5 years in CELL NO J 18 of SOR 2.

e) In case of any variation of the total NPV of O&M price, the NPV of O&M amount for total 5 years mentioned at CELL NO J 18 of SOR 2 will be considered for evaluation purpose.

12. INR = 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.