



# Mahatma Phule Renewable Energy and Infrastructure Technology Limited

(Subsidiary of MPBCDC (Gov. of MH Undertaking))

## TENDER NOTICE

MAHAPREIT intends to invite tender to obtain offers from reputed & experienced solar power developers for the design, engineering, supply, erection, testing and commissioning of 50 MW (AC) solar power plant on EPC basis. The last date of submission is 21.08.2023. Details of the tender can be viewed on <https://mahapreit.in> website.

Executive Director (Admin)

# 8X4



# महात्मा फुले नविनीकरणीय ऊर्जा व पायाभूत प्रौद्योगिकी मर्यादित

(म.फु.मा.वि.म. ची उपकंपनी, महाराष्ट्र शासनाचा उपक्रम)

## निविदा सूचना

महाप्रित, ५० मेगावॉट (एसी) सौर संयंत्राचा आराखडा, अभियांत्रिकी, पुरवठा, उभारणी, चाचणी व कार्यान्वयन ईपीसी तत्वावर करण्याकरिता विख्यात व अनुभवी सौर उर्जा विकासकांकडून देकार मिळविण्यासाठी निविदा मागवित आहेत. सादर करण्याचा अंतिम दिनांक २१.०८.२०२३ आहे. निविदेचा तपशील <https://mahapreit.in> या संकेतस्थळावर पाहता येईल.

कार्यकारी संचालक (प्रशासन)



# **Mahatma Phule Renewable Energy and Infrastructure Technology Limited. (MAHAPREIT)**

(A Wholly Owned MPBCDC, Govt of Maharashtra Company)

**(Open Tender Basis)**

**(Domestic Competitive Bidding)**

**BID DOCUMENT**

NOTICE INVITING TENDER FOR DESIGN, ENGINEERING, MANUFACTURE, SUPPLY, ERECTION, TESTING AND COMMISSIONING OF 50 MW AC CRYSTALLINE SOLAR PV TECHNOLOGY GRID INTERACTIVE SOLAR PV POWER PLANT WITH ASSOCIATED HT OVERHEAD/UNDERGROUND TRANSMISSION LINE UP TO THE POINT OF INTERCONNECTION INCLUDING FIVE (5) YEARS OPERATION & MAINTENANCES ON EPC BASIS AT DIST. SANGLI, MAHARASHTRA.

**(DOMESTIC COMPETITIVE BIDDING)**



**Regd & Corporate Office**

B-501 Pinnacle Corporate Park,  
Next to Trade Center, BKC,  
Bandra (East), Mumbai – 400051  
Website: <https://mahapreit.in>  
CIN No: U40106MH2021SGC358784

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## **SECTION – I**

# **NOTICE INVITING TENDER (NIT)**



**Mahatma Phule Renewable Energy and Infrastructure Technology Limited. (MAHAPREIT)**  
**(A Wholly Owned MPBCDC, Govt of Maharashtra Company)**

**(Open Tender Basis)**

**(Domestic Competitive Bidding)**

**NOTICE INVITING TENDER**

BID DOCUMENT NO: MAHAPREIT/SEP-02/06-23

July, 2023

**SUBJECT:** Notice inviting tender for Design, Engineering, Supply, Construction, Erection, Testing, Commissioning, and Five (05) years comprehensive Operation & Maintenance of total 50 MW(AC) grid connected solar PV power plant in the state of Maharashtra.

1.1. The Mahatma Phule Renewable Energy & Infrastructure Technology Limited, Mumbai, India (MAHAPREIT) invites online Bids on open tender basis Single Stage Two Envelope (i.e., Envelope-I: Techno-Commercial Bid and Envelope-II: Price Bid) for "Design, Engineering, Supply, Construction, Erection, Testing, Commissioning, and Five (05) years comprehensive Operation & Maintenance of total 50 MW(AC) grid connected solar PV power plant in the Sangli District of State of Maharashtra. The Solar Modules to be used for this project shall be sourced only from the Model and Manufactures included in the latest "Approved List of Models and Manufactures (ALMM)" issued by MNRE.

1.2. The Project shall be installed at following locations for total 50 MW(AC)

<b>Project Location</b>	<b>Latitude, Longitude</b>	<b>Substation Location</b>
KUNDALPUR	17° 11'42.05"N, 74° 8'6.9017"E	220 kV Ghatnandre substation of MSETCL
TISANGI	17.14937842° 'N, 74.86603461°E	
RAJURI	17.14937842°N, 74.86603461°E	
GHATNANDRE	17.1744206°N, 74.866785°E	

**Note:** Bidders may note that the land availability at aforementioned locations is estimated and may vary depending upon the land acquisition. Some alternative land location nearby to the substation or aforementioned may be prescribed while issuing the Notice to Proceed post award of LOA by MAHAPREIT.

**1.3. Brief Details/Key Input**

S. No.	Description of Item	Particulars										
1.	Brief Scope of Work	"Design, Engineering, Supply, Construction, Erection, Testing, Commissioning, and Five (05) years comprehensive Operation & Maintenance of total 50 MW(AC) grid connected solar PV power plant in the Sangli District of State of Maharashtra, as described in technical specification.										
2.	(a) Duration of Engineering, Procurement and Construction (EPC) (b) Duration of Comprehensive Operative & maintenance (O&M)	a) 380 days from the date of issuance of Letter of Award (LoA) to the contractor. The execution period for the Contractor will be linked with Notice to Proceed to be issued by the MAHAPRIET post land acquisition. b) 05 (Five) years from the date of completion of Commercial Operation Date (COD)										
3.	Cost of Bid document (non-refundable)	<p>INR 10,000.00 (Ten Thousand only) + 18% GST Bidders can pay for the cost of documents in the form of electronic transfer/NEFT payments in the following account details of MAHAPREIT:</p> <table border="1" data-bbox="651 1193 1399 1487"> <tr> <td data-bbox="651 1193 906 1317">Name of Party</td> <td data-bbox="906 1193 1399 1317">Mahatma Phule Renewable Energy and Infrastructure Technology Ltd.</td> </tr> <tr> <td data-bbox="651 1317 906 1361">Name of Bank:</td> <td data-bbox="906 1317 1399 1361">ICICI Bank</td> </tr> <tr> <td data-bbox="651 1361 906 1406">Account No:</td> <td data-bbox="906 1361 1399 1406">054405500470</td> </tr> <tr> <td data-bbox="651 1406 906 1451">IFSC:</td> <td data-bbox="906 1406 1399 1451">ICIC0000544</td> </tr> <tr> <td data-bbox="651 1451 906 1487">Address:</td> <td data-bbox="906 1451 1399 1487">MIDC, Andheri (East), Mumbai.</td> </tr> </table> <p>The Bidder shall be required to forward the copy of electronic fund transfer receipt from their registered E-mail ID to MAHAPREIT Email ID: <a href="mailto:cgm.sep@mahapreit.in">cgm.sep@mahapreit.in</a> &amp; <a href="mailto:cfo@mahapreit.in">cfo@mahapreit.in</a> requesting for access of download of the bidding documents in the working day.</p> <p><b>Bid without cost of bid document shall not be considered for the bidding and such bids shall not be opened by MAHAPREIT.</b></p>	Name of Party	Mahatma Phule Renewable Energy and Infrastructure Technology Ltd.	Name of Bank:	ICICI Bank	Account No:	054405500470	IFSC:	ICIC0000544	Address:	MIDC, Andheri (East), Mumbai.
Name of Party	Mahatma Phule Renewable Energy and Infrastructure Technology Ltd.											
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Address:	MIDC, Andheri (East), Mumbai.											

S. No.	Description of Item	Particulars										
4.	Processing Fee (Non-refundable)	Rs. 10,000 per MW + 18% GST to be paid through online payment. <b>Note:</b> Bidder should submit successful payment receipt with the bid document. Non-submission of Processing fee as mentioned in the Bid Information Sheet, such bids shall not be considered by MAHAPREIT.										
5.	Earnest Money Deposit (Bid security deposit)	INR 4.5 Lakh/MW on 50 MW(AC) capacity. <b>Total EMD is INR 2.25Cr (Rupees Two Crore Twenty Five Lakh only)</b> The bank detail of MAHAPREIT Ltd for Bank Guarantee is as under: <table border="1" data-bbox="635 792 1401 1088"> <tr> <td>Name of Party</td> <td>Mahatma Phule Renewable Energy and Infrastructure Technology Ltd.</td> </tr> <tr> <td>Name of Bank:</td> <td>ICICI Bank</td> </tr> <tr> <td>Account No:</td> <td>054405500470</td> </tr> <tr> <td>IFSC:</td> <td>ICIC0000544</td> </tr> <tr> <td>Address:</td> <td>MIDC, Andheri (East), Mumbai.</td> </tr> </table>	Name of Party	Mahatma Phule Renewable Energy and Infrastructure Technology Ltd.	Name of Bank:	ICICI Bank	Account No:	054405500470	IFSC:	ICIC0000544	Address:	MIDC, Andheri (East), Mumbai.
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Name of Bank:	ICICI Bank											
Account No:	054405500470											
IFSC:	ICIC0000544											
Address:	MIDC, Andheri (East), Mumbai.											
6.	Bid documents available for downloading	From 21.07.2023 at 1800 hrs to 21.08.2023 till 1800 hrs										
7.	Website for downloading of Bid documents/uploading of filled in Bid Response Sheets only in e-mode	<a href="https://organizations.maharashtra.nextprocure.in/">https://organizations.maharashtra.nextprocure.in/</a> <a href="https://mahapreit.in">https://mahapreit.in</a>										
8.	Date & Time of Pre-bid meeting	07.08.2023 at 1500 hrs										
9.	Venue of Pre-bid Meeting	MAHAPREIT, B-501 Pinnacle Corporate Park, Next to Trade Center, BKC, Bandra (East), Mumbai - 400051										
10.	Last date and time of submission of bid	21.08.2023 at 1500 hrs										
11.	Date & time of opening of Techno-commercial Bid	21.08.2023 at 1600 hrs										



12.	Date & time of opening of Price Bid	Will be intimated later on
13.	Address for submission of sealed hard copy of Techno-commercial bid & Opening of Bids	MAHAPREIT, B-501 Pinnacle Corporate Park, Next to Trade Center, BKC, Bandra (East), Mumbai - 400051
14.	Currency of Bids	Indian Rupees (INR)
15.	Bidders' eligibility	Bidders intending to participate in this bid shall fulfil the Eligibility Criteria as per Clause 1.4 of the NIT
16.	Period of Bid validity	180 days from the last date of submission of bids prescribed by MAHAPREIT and any extension thereof

MAHAPREIT reserves the right to cancel/withdraw this Invitation for Bids without assigning any reason for such decision.

*NOTE: This is an e-tender. Offers shall be submitted and processed in electronic mode only. Physical copies of required document will additionally need to be supplied for verification. The instructions to Bidder/terms and conditions appearing in this specification only shall be applicable.*

#### **1.4. BIDDER'S ELIGIBILITY CRITERIA**

Above tender is an Open Tender Enquiry on Domestic Competitive Bidding and all EPC Vendors from within India (hereinafter called "Bidders") shall be eligible to participate in NIT subject to fulfilling the following eligibility criteria:

##### **1.4.1. TECHNICAL CRITERIA**

The Bidder should meet the qualifying requirements stipulated hereunder in the last seven (07) years prior to the date of NIT.

1.4.1.1. The Bidder should have designed, supplied, erected/ supervised erection and commissioned the EPC of Solar Photo Voltaic (SPV) based grid connected power plant(s) of cumulative installed capacity of 25 MWp or higher capacity out of which at least one plant must be of 20 MWp or higher capacity.

The reference plant of 20 MWp or higher capacity must be in successful operation for at least three (3) months prior to the date of NIT.

OR

1.4.1.2. The Bidder should be an Indian company registered in India and should be Group company/Holding Company/Subsidiary company of a firm meeting the requirement (s) of Clause 1.4.1.1 above.

In such a case, Bidder shall furnish an Undertaking jointly executed by the

firm qualified as per clause 1.4.1.1 and the Bidder along with its bid for complete performance of the contract jointly or severally as per format enclosed in the bid document failing which the Bidder's bid is liable to be rejected.

### **Notes for Clause 1.4.1**

- a) The reference SPV based grid-connected power plant of 25 MWp or above capacity should be at a single location developed by Bidder for itself or any other client.
- b) SPV based Roof-top/Floating solar power projects, which are grid connected, shall also be considered eligible for QR purposes.
- c) For clause 1.4.1.1, Bidder shall submit LOA, certificate of successful completion and operation from the Owner.
- d) Direct/Indirect Order  
The Bidder shall also be considered qualified, in case the award for executing the reference work has been received by the Bidder either directly from the owner of the plant or any other intermediary organization. In such a case, a certificate from such owner of plant or any other intermediary organization shall be required to be furnished by the Bidder along with its Techno-Commercial bid in support of Bidder's claim of meeting the qualification requirement as per clause 1.4.1.1.
- e) Developer means an entity who has either executed or got executed the work/ project as owner of industrial projects.
- f) The Clause 1.4.1.1, refers to works for EPC related to minimum four of the following:
  - i. Supply of Solar Modules (Compulsory for EPC Works)
  - ii. Erection of modules
  - iii. Civil works including Module mounting structures/floater
  - iv. Inverters (Power Conditioning Units) and/or Inverter Transformers
  - v. Cables and Cabling Works

### **1.4.2. FINANCIAL CRITERIA**

#### **1.4.2.1. Cumulative Turnover of the Bidder for last three (3) financial years shall be at least 6.0 Cr. X 50 X 0.7 = 210 Cr**

1.4.2.2. The Net Worth of the Bidder during the last Financial Year shall be positive, wherein the Net Worth shall be calculated as follows:

*Net Worth = (Equity + Reserves) – (Revaluation reserves+ intangible assets + miscellaneous expenses to the extent not written off + carried forward losses).*

1.4.2.3. The Bidder shall provide a copy each of audited annual report to ascertain their turnover & net-worth.

1.4.2.4. The Bidder shall submit audited annual report of FYs 2019-20, 2020-

21, 2021-22 (if not audited then certification from Chartered Accountant shall be required).

- 1.4.2.5. In case a Bidder is an 80 % of subsidiary company & does not satisfy the annual turnover criteria, stipulated above on its own, its Holding Company would be required to meet the stipulated turnover requirements as above, provided that the Net Worth of such Holding Company as on the last day of the preceding financial year is at least equal to or more than the paid-up share capital of the subsidiary Company. In such an event, the Bidder would be required to furnish along with its Techno- Commercial Bid, a Letter of Undertaking from the Holding Company, supported by the Holding Company's Board Resolution, as per the format enclosed in the bid documents, pledging unconditional and irrevocable financial support for the execution of the Contract by the Bidder in case of award. Over and above bidder shall submit unconditional Bank Guarantee equivalent but not less than 3% of EPC price from holding company which shall be furnished within ten (10) days after Notification of Award.

## **1.5. SCOPE OF WORK**

- 1.5.1. The scope of the proposal shall be Design, Engineering, Supply, Erection, Testing, and Commissioning of 50 MW(AC) Grid connected Solar PV plant along with Switchyard and Power Evacuation system up to STU Sub-Station for the allocated capacity. The scope also includes Five (05) years Operation and Maintenance (O&M) of the solar PV plant including Switchyard, transmission lines and EHV bay at STU substation.
- 1.5.2. The scope of the contractor shall be deemed to include all equipment, materials and services which although are not specifically mentioned in the bid documents and/or in contractor's proposal but are necessary for the satisfactory operation of the Solar PV system and its integration with evacuation system provided by State Electricity Authority(s)/ MSETCL. Detailed scope of Supply and Services is mentioned in Section-V: Technical Specifications of this Bid Document.
- 1.6. Bidders who have been banned/ de-listed/ black listed/ debarred from business by any PSU/any Government Department/Ministry during last 03 (three) years shall be ineligible to bid. Self-declaration in this regard is to be submitted as per Attachment-05 of Section-V: BRS & Annexures.

## **1.7. PROCEDURE/REQUIREMENTS FOR E-TENDERING**

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- 1.7.1. Bidders are required to get registered with website <https://organizations.maharashtra.nextprocure.in> and/or <https://mahapreit.in> (if not already registered). After registration with and payment of the cost of bidding documents as per clause 1.3 above, Bidding Documents may be downloaded from Portal i.e. <https://organizations.maharashtra.nextprocure.in>.
- 1.7.2. Bidders shall be required to arrange all resources, including Digital Signature and Internet Connections at their own cost, for participating in online tenders/ bids at the portal.
- 1.7.3. All the Bidders are requested to get themselves registered well in advance and no extra time will be considered for the delay in on-line Vendor Registration, if any. In case Bidder waits till the last moment for uploading bids, and if any technical problem is encountered at that time and the bid closing time may elapses, MAHAPREIT shall not be responsible in any manner for such delay/ or any other reason thereof.

#### **1.8. CLARIFICATION OF BID SPECIFICATION**

- 1.8.1. Any prospective Bidder (subject to having paid the vendor registration and tender fees) who requires any clarification in respect of the Bid Specification may notify the MAHAPREIT in writing or by email enclosing therewith copy of successful online payment transaction against tender fee at the MAHAPREIT's contact details given below. The MAHAPREIT's response (including an explanation of the query but without identifying the source of enquiry) shall be published by way of revision of the Bid. Specification on website <https://organizations.maharashtra.nextprocure.in/>The Bidders in their own interest may inform the MAHAPREIT in written about the payment of tender fee by them and their detailed correspondence address with name of contact person, e-mail address etc. so that such clarifications can be sent to them by post/e-mail as may be possible. However, MAHAPREIT's responsibility is restricted to only publishing such clarifications on above mentioned website.
- 1.8.2. Bidder through the own cost and time visit the site. To participate in the Bid, Bidders are requested to mandatorily undertake a site-visit before pre-bid meeting. Ignorance of the site visit it is risk and cost of Bidder. Bidders are advised to undertake site visit before pre-bid meeting to understand the topography, soil and weather details at their own cost. Any assistance needed from MAHAPREIT to visit the site and project locations may be provided at sole owner option. The Bidder shall carefully examine the Bid Specification and fully inform and satisfy itself as to all the conditions and matters which may in any way affect to work or cost thereof. Failure to furnish all information required by the Bid Specification or to submit a bid not substantially responsive to the Bid Specification in every respect will be



at Bidder 's risk and may result in the rejection of the bid.

### **1.9. ASSISTANCE/CLARIFICATION REGARDING E-TENDERING PROCESS**

1.9.1. A Bidder if, find any discrepancies or omissions in the Bid Specifications or have any queries with respect to any provision of the Bid Specifications, he shall at once notify to the MAHAPREIT at below mentioned address:

Chief General Manager (SEP)

Mahatma Phule Renewable Energy & Infrastructure Technology Limited.

B-501 Pinnacle Corporate Park, Next to Trade Center,

BKC, Bandra (East), Mumbai - 400051

Email: [cgm.sep@mahapreit.in](mailto:cgm.sep@mahapreit.in)

Phone No: +91- 9819321398

### **1.10. REVISION OF BID SPECIFICATION**

1.10.1. At any time prior to the deadline for submission of bids, the MAHAPREIT may, for any reason, whether at its own initiative revise the Bid Specification. Every time the Bid Specification is revised, the revisions/amendments/revised bid Specifications shall be published on website <https://organizations.maharashtra.nextprocure.in/> , in seven (7) days prior to last date of bid submission (the revision no. of the Bid Specification shall be accordingly enhanced). Such revisions shall be binding on all the prospective Bidders irrespective of whether they have paid the tender fees prior to the revision or not.

1.10.2. In order to give prospective Bidders reasonable time to take the revisions into account for preparing their Bids, the MAHAPREIT may, at its discretion, extend the deadline for the submission of bids. The MAHAPREITs decision about the extension of deadline of submission shall be final and binding on the Bidders and no correspondence shall be entertained in this regard.

### **1.11. BID SECURITY/ EARNEST MONEY DEPOSIT (EMD)**

1.11.1. The Bidder shall furnish, as part of its bid, a bid security as specified in clause 2.9 of bid document. The bid security shall be in the amount stipulated in clause 1.4 above. The bid security must be submitted in the form provided at Annexure-7 in the bidding documents.

1.11.2. Any bid not accompanied by an acceptable EMD of requisite value and validity in accordance with Clause No 2.12 shall be rejected by MAHAPREIT as being non-responsive and returned to Bidders without being opened.

1.11.3. Preference to MSME/SSI registered with MSME/National Small Industries Corporation (NSIC)/Designated Agency/Startups as recognized by DIPP will be governed by the regulation(s) of the Government of India issued from time to time. Bidders are required to submit a copy of valid MSME/NSIC Certificate/Certificate of recognition as start up from DIPP/relevant certificate along with their bids in accordance with the procedure stipulated in the bid documents in a separate envelope at the time of submission of



bid as per provision of NIT. Non-submission of valid certificate along with the bid may lead to denial of exemption/ preference sought / allowed and such bids shall be treated as bids with non-submission of required EMD & shall be dealt as per clause 1.11.2 above and/or Clause 2.9 of Section II.

1.11.4. No interest will be paid on bid security irrespective of mode of submission.

1.11.5. In the exceptional circumstances, prior to expiry of the original validity period of the bank guarantee furnished as Bid Security, MAHAPREIT may request the Bidders to extend the period of validity for an additional period. In such case the Bidders shall provide the extended bid securities no later than ten (10) days prior to the expiry of the Bid Security. MAHAPREIT reserves the right to reject the Bid submitted by any Bidder who fails to extend the validity of the Bid Security in line with the provisions of this clause.

### **1.12. INSURANCE**

1.12.1. The Bidder / lead member shall bear the responsibility to arrange for project insurance along with PV modules and other major components of the project. This insurance encompassing all the probable risks associated with the proposed Solar Power Project.

1.12.2. All the expenses in relation to such insurance of the project will have to be borne by the Bidder for the contract period, as per clause no. 12 in contract agreement.

### **1.13. TRACK RECORD**

1.13.1. The Bidder shall have the good track record and shall not have been blacklisted/Banned for the participation in tender issued by the entity, government/ semi government organization in any country as on date of submission of bid. The Bidder shall submit an affidavit to that effect. MAHAPREIT, may reject the bid, if such affidavit is not furnished or contract may be terminated if any information found incorrect at any later stage.

### **1.14. PROJECT DEVELOPMENT COMPETENCE**

1.14.1. The Bidder shall submit declaration of proposed vendors for material and equipment along with their credentials and supporting documents for the items such as: PV modules, MMS structure, DC cables, String Monitoring system, inverters, transformers for the capacity for which the Bidder is bidding for.

1.14.2. The Bidder shall also submit the list of technical personnel who will be deployed for the block of along with their technical qualifications and experience in Solar PV field.

1.14.3. The details of the consultants / in house capabilities to be deployed for

design, engineering, installations and supervision shall be submitted to MAHAPREIT prior to start of the work.

- 1.14.4. Sub-Contractors/Vendors: Details and list of the sub-Contractor/Vendors along with details of experience and technical qualification will have to be submitted to MAHAPREIT before engagement of sub-Contractors/Vendors. Details of O&M agency to be submitted during bid submission.

### **1.15. EXCLUSIVITY**

- 1.15.1. The Bidder can either submit the bid in his individual capacity or in Consortium /JV with another partner.
- 1.15.2. The partners in the Bidding Consortium/ JV shall not separately participate as independent Bidders or as members of any other Consortium /JV in this Bidding process. All bids in contravention of this shall be rejected.

### **1.16. RIGHT TO ACCEPT/ REJECT**

Tenders from Bidders will be admitted to the procedure provided that none of the following reasons for exclusion apply:

- 1.16.1. The Bidder is a state-controlled company in the partner country that is not legally or economically independent, or that is not subject to commercial law, or that is a public authority dependent on the contracting agency or the project executing agency or the recipient of the loan/financing amount;
- 1.16.2. The Bidder or individual members of the Bidder's staff or a sub-Bidder has economic links or family ties with personnel of the contracting agency who are involved in preparing the tender documents, awarding the contract or supervising the execution of the contract, insofar as the conflict of interests could not be resolved to MAHAPREIT's satisfaction in advance of the contract award and execution phase;
- 1.16.3. The Bidder is or was involved as a consultant in the preparation or implementation of the project. The same applies to an enterprise or an individual that is closely connected to the Bidder under a company group or a similar business link, or to several enterprises or individuals associated correspondingly. (exception: In BOT projects or turnkey projects a participation of future suppliers or manufacturers may even be desirable);
- 1.16.4. The Bidder or individual members of the Bidder's staff or a sub-Bidder are not or were not during the last 12 months prior to publication of the invitation to tender indirectly or directly linked to the project in question through employment as a staff member or advisor to the contracting agency, and are not or were not able in this connection to influence the award of the contract for services, or the Bidder is not or was not otherwise able to influence the award of the contract for services.
- 1.16.5. MAHAPREIT reserves the right to reject any or all of the responses to NIT or cancel the NIT or annul the bidding process for any project at any stage without assigning any reasons whatsoever and without thereby any liability.
- 1.16.6. For any enquiry/ clarification regarding detailed Tender for this assignment,



the Bidder may contact at the following address for communication:  
Chief General Manager (SEP)  
Mahatma Phule Renewable Energy & Infrastructure Technology Limited.  
B-501 Pinnacle Corporate Park, Next to Trade Center,  
BKC, Bandra (East), Mumbai - 400051  
Email: [cgm.sep@mahapreit.in](mailto:cgm.sep@mahapreit.in) Phone  
No: +91- 9819321398

**\*\*\*\*\*END OF SECTION\*\*\*\*\***





## **SECTION – II**

# **INSTRUCTIONS TO BIDDERS (ITB)**



## Section –II: Instructions to Bidders

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## 2.1. PROFILE

- 2.1.1. MNRE, New Delhi has rolled out the scheme of Solar Park to fulfil the ambitious target of setting 100 GW Solar Plants in India. Also, Govt. of Maharashtra has announced the State Renewable Energy Policy 2020 to setup 17360 MW renewable energy projects in Maharashtra, out of which 10000 MW is projected from solar energy.
- 2.1.2. The Mahatma Phule Backward Class Development Corporation Ltd is set up by the Govt. of Maharashtra as on 10th July 1978 for the economic upliftment of scheduled Castes and Nav- Buddha's MPBCDC LTD is known for its pioneering & innovative welfare- oriented programs & schemes for the backward class communities.
- 2.1.3. Mahatma Phule Renewable Energy and Infrastructure Technology Ltd. (MAHAPREIT) a subsidiary company of Mahatma Phule Backward Class Development Corporation Ltd is incorporated under the Company's Act 2013(18 of 2013) on 12/04/2021.

## 2.2. GREEN ENERGY INITIATIVE OF MAHAPREIT

- 2.2.1. MAHAPREIT proposes to set up Solar Plants of a Total 1050 MW capacity in all 6 Revenue divisions under GoI policy of solar PV projects through Government Producers using indigenous modules to facilitate national energy security and environmental sustainability for government purpose valid till 2022-23. MAHAPREIT has proposed to set up Solar Park of capacity 1050 MW. Out of which MAHAPREIT has decided to develop around 50 MW Solar Park at Sangli and the land for the same has been identified.

### **MAHAPREIT will implement the project by awarding EPC Contract through Competitive Bidding.**

#### 2.2.2. LOCATION & APPROACH

Location	Sangli district in Maharashtra
Nearest Highway	National Highway 166H
Nearest Railway Station	Sangli Railway Station /Miraj Railway Station
Nearest Commercial Airport	Pune International Airport
Indicative Coordinate	17.174°N, 74.866°E

#### 2.2.3. LAND AVAILABILITY

Land Availability	Plant will be located near villages Kundalapur, Tisangi, Rajuri and Ghatnadre Notice to proceed will be issued to successful bidder for initiating the scope of work post land acquisition.
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### 2.3. ELIGIBLE BIDDERS

- 2.3.1. The Bidding process is on open tender basis to all eligible Bidders from within India who meet the Eligibility Criteria as per clause 1.4 of Section-I: Notice Inviting Tender.

### 2.4. GENERAL INSTRUCTIONS

- 2.4.1. The Bidder shall be deemed to have carefully examined the terms and conditions, procedures, Specifications, Forms and Formats, Annexures/ schedules, Attachments etc. in this Bid Document and also to have satisfied himself as to the nature and character of the plant and equipment to be supplied and installed under the Contract, the proposed Solar Power System(s), site conditions and all relevant matters & details. The Bidders shall also be deemed to have carefully examined the terms & conditions, specification etc.
- 2.4.2. Though adequate care has been taken while preparing the Bid Document, the Bidder shall satisfy himself that the document is complete in all respects. It is Bidder's responsibility to satisfy itself that the information/documents are adequate and that there is no conflict between various documents/stipulations. No dispute or claims be entertained on this account. Bid preparation is the responsibility of the Bidder and no relief or consideration will be given for errors and omissions.
- 2.4.3. Bids shall be evaluated based on the information/ documents submitted in the Bid. Hence, Bidder should ensure that all information listed under this Bid Documents to be submitted with the bid has been attached /enclosed in appropriate envelopes. Failure to furnish relevant information and documentary evidences as stipulated in the Bid Document or submission of a Bid that is not substantially responsive to the Bid Document in all respects shall be liable to be rejected.
- 2.4.4. Bidders may note that the successful Bidder selected by MAHAPREIT based on this NIT, shall set up Solar Power Project in compliance with the provisions of the Bid Document.
- 2.4.5. The specification provided with this Bid Document outlines the functional requirement. The Bidder must submit the Bid based upon their own design, meeting the functional requirements as specified in the specifications.
- 2.4.6. Prospective Bidder acknowledges and agrees that response to the NIT is purely voluntary action on their part and for any expenditure on this account by them, MAHAPREIT will have no obligation or liability to the Bidders in the event of cancellation of NIT.



2.4.7. While the Employer has invited this NIT and has requested Bidders to submit their Bids, the Employer shall always be at the liberty to withdraw this NIT at any time before issue of LOA to the successful Bidder by MAHAPREIT.

## 2.5. COST OF BIDDING

The Bidder shall bear all costs associated with the preparation and submission of the bids. In no case, MAHAPREIT shall be responsible for these costs regardless of the conduct or outcome of the bidding process.

## 2.6. THE BID DOCUMENT

2.6.1. Notice Inviting Tender (NIT)/Bid Document comprises of the documents listed below and addendum issued in accordance with Clause No 2.8: -

- Section-I: Notice Inviting Tender (NIT)
- Section-II: Instructions to Bidders (ITB)
- Section-III: Conditions of Contract (CC)
- Section-IV: Bid Response Sheets (BRS) & Annexures (BRS & Annexure)
- Section-V: Technical Specifications (TS)

2.6.2. The Bidder is expected to examine all instructions, forms, terms, specifications, and other

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information in the bid documents. Failure to furnish requisite information as per the bid documents or submission of a bid not substantially responsive to the bid documents in every respect will be at the Bidder's risk and may result in rejection of its bid.



## 2.7. BIDDERS' QUERIES/CLARIFICATIONS

- 2.7.1. Bidders may submit their queries/clarifications regarding the Bid Document, if any, in writing either by email or post and it must be received to Tender Inviting Authority one (01) days before the scheduled pre-bid meeting date.
- 2.7.2. MAHAPREIT shall not be obliged to respond to any request for clarification received later than the above period. Further, the mere request for clarification from the Bidders shall not be a ground for seeking extension in the deadline for submission of bids. Employer's response (including an explanation of the query but not identification of its source) will be uploaded on portal, where the Bidder can see clarification/reply to query/ amendment to the Bid Documents, if any.

## 2.8. AMENDMENTS OF BID DOCUMENT

- 2.8.1. At any time prior to the deadline for submission of Bids, MAHAPREIT may, for any reason, whether at its own initiative or in response to a clarification requested by a prospective Bidder(s), modify the Bid Document by issuing Addenda and shall be available only on following websites:

<https://organizations.maharashtra.nextprocure.in/https://mahapreit.in>

No press note will be released in this regard.

- 2.8.2. All such Addenda shall be integral part of Bid Document. The amendments to the bid documents will be binding on the prospective Bidders and the notification of the amendment communicated through portal, shall be deemed to be construed that such amendment(s) to the bid documents have been taken into account by the Bidder in its bid/proposal.
- 2.8.3. In order to allow prospective Bidders reasonable time in which to take the amendment into account in preparing their Bids, MAHAPREIT, at its discretion, may extend the deadline for the submission and opening of Bid.

## 2.9. BID SECURITY/EARNEST MONEY DEPOSIT (EMD)

- 2.9.1. The Bidder shall furnish, as part of its bid, a bid security as specified in 1.3 of section- I of NIT. The bid security shall be in the amount stipulated in the NIT. The bid security must be submitted in the form provided at Annexure-7 in the bidding documents.
- 2.9.2. The bid security shall be in the form of a bank guarantee from any Indian nationalized bank/scheduled bank in India in Indian Rupees (INR).
- 2.9.3. While issuing the physical BG, the Bidder's bank shall also send electronic message through secure Structured Financial Messaging System (SFMS) to the Employer Beneficiary bank whose details are

provided in NIT. Bidders



are advised to ensure that the message is sent by their bankers and the Bidders must submit the reference details along with the bid.

- 2.9.4. The format of the bank guarantee shall be in accordance with the form of bid security included in the bidding document. Bid securities shall remain valid for a period of 180 days, beyond the original validity period of the bid or beyond any period of extension subsequently requested under clause 2.12.
- 2.9.5. Any bid not accompanied by an acceptable bid security, shall be rejected by the Owner as being nonresponsive.
- 2.9.6. The Bid Security of the unsuccessful Bidders, shall be returned within 30(thirty) days from the date of issue of 'Letter of Award' to the successful Bidder."
- 2.9.7. No interest shall be payable on the amount of security.
- 2.9.8. The bid security of the successful Bidder will be returned when the Bidder has signed the Contract Agreement and has furnished the required CPSG.
- 2.9.9. The Bid submitted by a Bidder shall be treated invalid and the Bid security shall be forfeited:

- a. If the Bidder withdraws/ modify his bid within the bid validity specified in the Bid Specification.

OR

- b. The successful Bidder fails to submit performance guarantee and/ or to execute contract agreement within the prescribed period in accordance with the instructions to the Bidder.

OR

- c. If the Bidder being the successful Bidder fails to furnish the acceptance of Letter of Award, within the specified time limit.

OR

- d. If the Bidder gives any wrong / false information / documents in the bid for making the bid qualified (eligible).

OR

- e. Bidder fails to taken over the project land in specified time limit.

The EMD of the Successful Bidder shall be returned/released after,

- a) When the Bidder has signed the Contract Agreement pursuant to Instruction of Bidders

AND

- b) Acceptance of LOA by the Bidders

AND



- c) The submission of Bank Guarantee towards Contract performance by the Bidder and on acceptance of the same by the MAHAPREIT.

2.9.10. Unsuccessful Bidder's EMD will be discharged/returned/released as promptly as possible but not later than one month beyond the validity of the bid.

#### 2.10. LANGUAGE OF BID

2.10.1. The bid prepared by the Bidder and all correspondence and documents related to the bid exchanged by the Bidder and the Employer shall be written in English language. Supporting documents and printed literature furnished by the Bidders with their bids may be in another language, provided they are accompanied with a certificate of the authorized translator certifying therein an accurate translation of the relevant passages in the above stated language, in which case, for the purposes of interpretation of the Bid, the translation shall prevail. Failure to comply with this may disqualify a bid.

#### 2.11. BID CURRENCY

2.11.1. The Bidder shall quote all prices in Indian Rupees only. No other currency shall be acceptable.

#### 2.12. PERIOD OF BID VALIDITY

2.12.1. Bids shall remain valid for a period of 180 days after the closing date prescribed by MAHAPREIT for the submission of bids. A bid valid for a shorter period shall be rejected by the Employer as being non-responsive.

2.12.2. In exceptional circumstances, prior to expiry of the original bid validity period, MAHAPREIT 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 e-mail/fax. A Bidder agreeing to the request will not be required or permitted to modify its bid. If Bidder refuse to extend the period of bid validity, the bid of such Bidder shall not be considered for further evaluation.

#### 2.13. FORMAT AND SIGNING OF BID

2.13.1. The Bid submitted by the Bidder must be digitally signed by the person duly authorized to sign on behalf of the Bidder. Each page of the Bid should be numbered and properly signed. Contents and pages should be indicated in the index page. The name of the person signing the bid should also be typed or printed below the signature.

2.13.2. Bid must be signed with the legal name of the Corporation /Company by the person authorized to sign the bid on behalf of such Corporation / Company in the matter.

2.13.3. Satisfactory evidence of authority of the person signing on behalf of the Bidder shall be furnished on non-judicial stamp paper of an appropriate value with the hard copy of bid in the form of a Power of





Attorney, duly notarized by a Notary Public along with copy of Board Resolution (in original or notary attested copy), indicating that the person signing the bid has the authority to sign the bid and that the bid is binding upon the Bidder during the full period of its validity.

- 2.13.4. Each Bid shall contain no overwriting, alterations, omissions, or additions, unless such corrections are initiated by the person or persons signing the Bid. Corrections if any shall only be made by scoring out the cancelled portion, writing the correction, initiating and dating it by the person or persons signing the Bid.
- 2.13.5. The Bidder shall provide all the information sought under this NIT. MAHAPREIT will evaluate only those Bids that are received in the required formats and complete in all respects.
- 2.13.6. The Bid must be typed or written in indelible ink and signed and sealed at each page by the Bidder with his usual signature before submission.
- 2.13.7. The Bidder's name stated on the proposal shall be the legal exact name of the firm.
- 2.13.8. Bids not conforming to the above requirement of signing even after the clarifications sought in this regard by the Employer, shall be disqualified.
- 2.13.9. The Bidders are required to submit a **"No Deviation Certificate"** as per the Attachment No-6 of Section IV: Bid Response Sheets (BRS) and Annexures to this bid document. The Bidder also undertakes that in the event the Project is awarded to it, during execution of the Project, it shall not seek to alter any agreed contractual terms, conditions and specifications.

#### 2.14. DOCUMENTS COMPRISING THE BID

2.14.1. The Bid submitted by the Bidder shall comprise the following documents:

- i. Bid Form duly completed and signed by the Bidder, together with all Attachments identified in Clause No 2.15.2 below.
- ii. Price Bid to be upload online in the given format.

2.14.2. Bidder shall submit with its bid the following attachments:

**i. Attachment-1: Power of Attorney**

A power of attorney, as per Clause No 2.13.3, indicating that the person(s) signing the Bid has the authority to sign the Bid and that the Bid is binding upon the Bidder during the full period of its validity in accordance with Clause No 2.12.

**ii. Attachment-2: Submission of GST Details**

Bidders have to submit the GST details of their company at Attachment- 2 of Section-IV: BRS & Annexures of this Bid Document.

**iii. Attachment-3: Bid Security/Earnest Money Deposit requirement**

Bidder shall submit the Bid security/EMD requirement as per format specified at Annexure-7 of Section-IV: BRS & Annexures of this Bid Document.

- iv. **Attachment-4: Pre- Contract Integrity Pact**  
Integrity Pact duly signed between Employer and the Bidder in accordance with Clause No 2.30.
- v. **Attachment-5: Declaration regarding Blacklisting**
- vi. **Attachment-6: No Deviation Certificate**  
The Bidders shall submit a "**No Deviation Certificate**" to the updated bidding document in accordance with Clause No 2.13 of this Bid Document
- vii. **Attachment-7: Electronic Fund Transfer (EFT) details of the Bidder.**
- viii. **Attachment-8: Technical Criteria**  
Bidder shall submit the technical data in the prescribed format along with scanned copy of all the supporting documents to demonstrate fulfillment of the eligibility criteria as per Clause No. 1.4 of this Bid Document.
- ix. **Attachment-9: Financial Criteria**  
Bidder shall submit the financial data in the prescribed format along with scanned copy of all the supporting documents to demonstrate fulfillment of the eligibility criteria as per Clause No. 1.4 of this Bid Document.
- x. **Attachment-10: Net Annual Guaranteed Generation for the proposed Solar PV Power Plant**  
Bidder shall quote the Net Annual Guaranteed Generation for first year to be determined as per Appendix-A to Attachment-10 along with the documentary proof for arriving at the Declared Net Annual Guaranteed Generation (NAGG) such as Energy Estimation Report using the latest software such as PV Syst, Meteororm for each unit for which the Bidder is seeking qualification.
- xi. **Attachment -11: Time Schedule**  
Bidder shall submit the detailed activity wise Time schedule (L1 Schedule) for each unit for which the Bidder is seeking qualification in the form of PERT Chart covering all aspects like ordering, site preparation, Supply, erection, installation, testing & commissioning, etc. along with the bid.
- xii. **Attachment-12: List of Vendors/sub-contractors proposed to be engaged.**
- xiii. **Attachmnt-13: Mandatory Information to be submitted by the Bidder.**
- xiv. **Attachment 14: Format for Month Wise Target Generation for the proposed**
- xv. **Attachment -15: Undertaking regarding restrictions imposed by the**
- xvi. **Attachment -16: Declaration for compliance to ALMM.**
- xvii. **Attachment -17: Estimated Bill of Quantities**
- xviii. **Attachment-18: Schedule of Tools & Tackles for Erection, Testing, Commissioning and O&M for each unit for which the Bidder is seeking qualification.**
- xix. **Attachment no 19: Declaration regarding Import Content.**

2.14.3. The bid should be serially numbered and properly indexed mentioning all constituents of bid including any enclosures/attachments etc. and their location page numbers in the bid. Failure to submit the bid in systematic manner as above may result oversight of any important information provided by the Bidder for which MAHAPREIT shall not be responsible.

#### 2.15. BID PRICE AND BID CURRENCY

2.15.1. The Bidder shall quote his lowest prices inclusive of all taxes & duties for Design, engineering, manufacture, supply, erection, testing and commissioning of 50MW AC Solar PV Technology GridInteractive Solar PV Power Plant at Sangli district in the state of Maharashtra with associated power evacuation infrastructure arrangement including 5 years' operation & maintenance of same.

2.15.2. Bidder shall be quoting the following information in their bid for specified technical scope of work under Section – II,

- a) Price (L) in INR per MU inclusive of all applicable taxes & duties.
- b) Guaranteed Annual Generation (G) in MU > G'. (G' is as per Section IV)
- c) DC/AC ratio = Cumulative DC capacity of the solar arrays / Cumulative rated AC capacity of inverters at reference ambient temperature as per specification.
- d) Contract Price will be calculated using following formula,
- e) Contract Price (X) = Price Per MU (L) x Guaranteed Annual Generation (G) in INR.

2.15.3. This charges/fees shall be inclusive of all taxes, current service taxes, incidentals, overheads, traveling expenses, printing and binding of Reports, expenditure related to presentations to be made during the execution of assignment, sundries and all other expenditure for execution of this services as per "Terms of Reference or RFP", indicated in the tender Document and also the tasks the consultant may think shall be carried out in order to meet the objectives of the assignment.

2.15.4. Any rise in the taxes and fees will not be paid extra subjected to the Cl. No.1.36 of Variations in section III of General terms & conditions.

2.15.5. The Contract Price shall be paid as per the milestone payments as prescribed in the RfP.

2.15.6. Income Tax and Profession Tax, any other tax as per Statutory Provisions of Govt. of India and Maharashtra State shall be deducted by the Employer from each invoice. A certificate in this regard shall be provided by the Employer.

2.15.7. The Bidder shall quote fixed price inclusive of all the applicable taxes providing the tax breakup. The bid price shall be the sum total of lump sum



price quoted by the Bidder for entire scope of work. The Bidder shall indicate the Bid Price in Indian Rupees only.

## 2.16. SUBMISSION OF BID

2.16.1. The Bid shall be submitted online in two parts as stated hereunder in this Clause. Submission of the online bid by any other means shall not be accepted by the Employer in any circumstances.

2.16.2. Authorized signatory holding Power of Attorney with his digital signature on behalf the Bidder shall upload Bid Response Sheets and requisite documents along with copies of certificates/supporting documents on the website <https://www.bharat-electronictender.com> before the last date & time set for submission of bids in the following two envelopes.

Envelope - I: Techno-commercial Bid

Envelope- II: Price Bid

### **2.16.3. Envelope – I: Techno-Commercial Bid**

Techno- commercial Bid shall contain the following:

- a) Bid Form duly completed and signed by the Bidder
- b) Attachments No. 1 to 20 as mentioned in Clause No 2.14.2 together with all supporting documents, which the Bidder wishes to submit as part of his Techno- commercial Bid.
- c) Scanned copies of Technical Particulars in accordance with the Section-IV: Technical specifications (TS).

Techno-Commercial Bid should not contain any price content entry. In case, the Techno-Commercial Bid is found to contain any price content, such bid shall be out rightly rejected.

### **2.16.4. Envelope-II: Price Bid**

- a) Bidders are required to submit unit wise prices in the price bid (in electronic form of financial part of ETS portal) in conformity with the Bid Document for the capacity in which Bidder is seeking qualification. In case, Bidder omits to submit the prices for the unit(s) in which the Bidder is interested, then such Bidder will not be considered for further evaluation of that unit.
  - b) The Bidder has to quote the total price (excluding GST) for project in electronic form as per clause 2.16.4 above considering price break up sheet uploaded by Employer in excel as well as EBV price as per clause 2.23 in the electronic form of ETS portal only. Only Prices quoted in electronic form of financial part shall be considered for evaluation.
- 2.16.5. Further, after the issuance of LOA, successful Bidder(s) shall submit item wise price break up for all the items to Employer in the prescribed format /price break up sheet uploaded by Employer in excel within 2 hours of conclusion of the bid process. No price break up sheet in excel shall be uploaded with price bid. No material relating to any



Technical matters shall be included in the Price Bid.

**2.16.6.Submission of documents in physical form:**

The following documents shall also be submitted in physical form on or before the Last date and time for submission of Bids through post/courier or by hand on the address mentioned in Bid Documents. The sealed envelope shall be super-scribed "Documents to be submitted in Physical form against NIT Ref No. MAHAPREIT/SEP-02/06-23

- i. Cost of bidding document- transaction slip.
- ii. Bid Security/Earnest Money Deposit requirement as per Attachment -3.
- iii. Integrity Pact in original duly signed and stamped (as per Attachment - 4 of Section V: BRS & Annexures)
- iv. Power of attorney duly notarized by a Notary Public along with copy of Board Resolution (in original or Notary attested copy) for the authorized signatory.
- v. Pass phrase for opening of bid

**2.17. SUBMISSION OF COPIES OF CERTIFICATES/ DOCUMENTARY PROOF**

2.17.1. Bidders are required to submit/upload copies of all supporting certificates/ documentary evidences as well as the other requisite documents required as per bid document. Non- submission of copies of requisite certificates/documents may render the bid non-responsive, and shall be liable for rejection.

**2.18. DEADLINE FOR SUBMISSION OF BIDS**

2.18.1. The complete Bids must be uploaded on the MAHAPREIT's e-tendering portal and the complete set of documents to be submitted in physical form must be received by MAHAPREIT at the address specified in the bid document not later than the time and date stated in the NIT. In the event of the specified date for submission of bids being declared a holiday for MAHAPREIT, the bids will be received up to the appointed time on the next working day. However, the date and time for online submission of the Bids shall continue to be the date and time specified or amendment notified in this regard.

2.18.2. MAHAPREIT may, at its discretion, extend this deadline for submission of bids by amending the bid documents, in which case, all rights and obligations of MAHAPREIT and Bidders will thereafter be subject to the deadline as extended.

**2.19. LATE BIDS**

2.19.1. Online submission of the Bid will not be permitted on the portal after expiry of submission time and the Bidder shall not be permitted to submit the same by any other mode. Similarly, physical documents, if received by the

Employer after the deadline for submission of Bids prescribed in NIT, then it will be considered as 'Late Bid' notwithstanding the fact that the Bidder has uploaded the Bid online within the stipulated deadline. In such a case, the uploaded online Bid on the portal shall be considered as non-responsive and shall not be processed further. Employer shall not bear the responsibility of delay in submission of Bid due to Courier/postal delays.

## 2.20. MODIFICATION AND WITHDRAWAL OF BIDS

- 2.20.1. In case any clarifications are sought by the Employer after opening of Techno- commercial Bids, then the replies of the Bidder should be restricted to the clarifications sought. Any Bidder who modifies its Bid (including a modification which has the effect of altering the value of its Price Bid) after opening of Bid without specific reference by the Employer, shall render the Bid liable to be rejected without notice and without further reference to the Bidder and its EMD is liable to be forfeited.
- 2.20.2. No Bid may be withdrawn in the interval between the bid due date and the expiration of the validity period of the Bid. Withdrawal or unsolicited modification of a Bid during this interval shall result in the Bidder's forfeiture of its EMD.

## 2.21. BID OPENING

- 2.21.1. The Employer shall open, examine and evaluate the Bids in accordance with the provisions set out in this bid document. In case of the unscheduled holiday being declared on the prescribed opening day of the Bid, the next working day shall be treated as the scheduled day of opening of the Bid.
- 2.21.2. The Techno-commercial and price bids will be opened at the time and date set for opening for bids in the presence of representatives who may wish to be present.
- 2.21.3. The price bid of techno-commercially qualified Bidders shall be opened in the presence of representative of such Bidders who wish to be present at a subsequent date and time for which the separate intimation will be sent to the techno-commercially qualified Bidder.
- 2.21.4. Bidder's representatives shall sign a register only as proof of their attendance.
- 2.21.5. Bidder's names, bid prices, the presence or absence of bid security/EMD and other such details as the Employer, at its discretion, may consider appropriate, will be announced at the opening of Bids.
- 2.21.6. Bids not covering the entire scope shall be treated as incomplete and hence may be rejected.
- 2.21.7. The Employer further, reserves the right to reject any bid, which is not submitted according to the instructions stipulated above.

## 2.22. CLARIFICATION ON BIDS

- 2.22.1. During the evaluation of the Bids, MAHAPREIT may at its discretion seek clarification(s)/ confirmation(s) from the Bidders on their bids. The request for such clarification(s)/ confirmation(s) shall be in writing and no change in the price or substance of the bid shall be sought, offered or permitted. The Bidder will be required to submit their clarification within the time as specified by the Employer in the request for clarification letter. If the clarification(s)/ confirmation(s) sought from the Bidder are not received in stipulated period, then evaluation will be done based on available data in their bids and non-submission of requisite supporting document/data by the Bidder may lead to non-responsive/rejection/disqualification of bids. No clarification at the initiative of the Bidder after submission of bids shall be entertained.
- 2.22.2. Submission of such clarification(s)/confirmation(s)/historical information shall not be considered as material deviations. However, this information can only be submitted by the Bidder, if MAHAPREIT requests for such information,

## 2.23. BID EVALUATION CRITERIA AND SELECTION PROCEDURE OF THE BIDDER

Parties who intend to participate in this e-tender and meets the eligibility criteria as mentioned at Clause No 1.4 of this Bid Document will have to submit their Techno- commercial Bid and Price Bid ("Offer") in accordance with the procedures, terms and conditions as mentioned in this Bid Document. Eligible Bidders complying the requirements of the Bid document shall be evaluated in two stage process as herein below:

### 2.23.1. Techno-Commercial Bid Evaluation

- i. At this stage, bids of each Bidder will be evaluated on the basis of terms & conditions of NIT viz. bid security (EMD), the correctness & validity of required undertaking/agreements/Board resolutions/experience certificates/technical data sheets /annexure/ certificates/financial documents/ performance certificates/vendor credentials documents etc. submitted by Bidder under prescribed format according to the NIT, Bidders financial & technical capability as per qualifying requirement, confirmation of technical specifications of the major equipments offered by the Bidders, the guaranteed generation offered by the Bidder.
- ii. MAHAPREIT will appoint a Technical Bid Evaluation Committee at its own discretion for evaluation of technical bids submitted by the Bidders.
- iii. Bidder whose bid found complete in all respect and in line with NIT terms & conditions without any deviations and which offers the required equipments/material along with guaranteed electrical energy generation as per the technical specifications mentioned in the NIT will be considered technically qualified Bidder.

### 2.23.2. Price Bid Evaluation

- i. Only after the Technical Evaluation has been finalized, the price bids of those Bidders that qualified during the evaluation of the technical bids shall be opened.
- ii. Bidder shall quote the Total Bid price per MU required for setting up the Solar PV Project in the financial part of bid.
- iii. The minimum generation ("G") and their point of power measurement is shown below:

Sr. No	Project capacity	Point of interconnection / measurement	Minimum Annual Generation ("G")
1	50 MW(AC)	220/132 kV Ghatnandre Substation of MSETCL	75.77 MU

- iv. Bidders shall quote the following information in their bid:
  1. Quoted Price (L) in INR per MU inclusive of all applicable taxes & duties.
  2. Quoted Guaranteed Annual Generation (G) in MU > G'.  
Bidders are required to choose the DC/AC ratio at their own discretion however, they are expected to meet the CUF of minimum 19% post one year of completion during project life.
- v. Project Contract Price (X) = (L) x (G) in INR  
Where, 1% of Contract price will be treated as O& M Contract price, which will be paid in 60 monthly bills i.e., for the O& M period of 5 Years.
- vi. **Bidder with lowest Project Contract Price (L) will be considered the Successful Bidder.**  
L1 Bidder is the Bidder who has quoted lowest price per MU inclusive of all applicable taxes and duties for Quoted Guaranteed Electric Energy Generation (QGEEG) as per above.
- vii. If quoted lowest price per MU inclusive of all applicable taxes and duties is equal for more than one Bidder for Quoted Guaranteed Electric Energy Generation (QGEEG), then following Tie Breaker will be applicable.  
**"Bidder with highest QGEEG will be considered as "L1-Bidder"**
- viii. The QGEEG in MUs and Project Contract Price will be considered up to two (2) decimals only.
- ix. Only L1 Bidder shall submit signed hard copy of detail price break up for EPC cost, matching with the Balance of Material, Mandatory Spares and O&M costs consider as mentioned above for 5 years within 10 Days from the date of LoA acceptance.
- x. All costs shall include ex-works price and all taxes & duties as applicable.  
The break up needs to be made available to MAHAPREIT with
  - Supply of material, with applicable taxes & duties rate.
  - Supply of services, with applicable taxes & duties rate

2.23.3. MAHAPREIT reserves the right to reject any or all bids or cancel/withdraw the Notice Inviting Tender (NIT) and annul the

process at any time prior to



the issuance of letter of Award to the Successful Bidder without assigning any reason whatsoever and shall bear no liability whatsoever consequent upon such a decision.

#### 2.24. CORRECTION OF ERRORS

- 2.24.1. The errors /discrepancies in respect of the specified amount in Bid ResponseSheets for an individual item and/or sub-item and/or in the sub-total of a Bid Response Sheet and/or in the Grand total of a Bid Response Sheet and/or in the lump sum price of the package either due to discrepancy between figures and words and/or simple arithmetical error while adding and/or multiplying and /or due to wrong extension of unit rates etc. the error will be rectified and computed by MAHAPREIT Ltd. as per the followingmethod:
- 2.24.2. In case of discrepancy between figures and words, the value specified in thewords will be considered for computation.
- 2.24.3. Firstly, the unit rates / percentage rate in words will be considered for computation.
- 2.24.4. In case unit rates / percentage rates are not indicated in words then unit rates indicated in figure will be considered and will be used for deriving theamount from the quantities specified in the bid documents.
- 2.24.5. In case error is due to variation of quantities, the quantities as specified inthe bid documents will be considered and multiplied by the quoted unit ratesto obtain the amount.
- 2.24.6. The items for which Bidder does not quote his price i.e., indicated as 'NIL'/'Zero', leaves the rate / amount columns blank, puts a (-) mark or indicates 'NA' etc. in the rate / amount column; cost shall be considered as "Inclusive" for bid evaluation for such items.
- 2.24.7. After computation of the amounts as above, the values as computed shall be considered for evaluation. If the Bidder does not accept the above consideration, his bid will be rejected and the bid security/EMD may be forfeited.

#### 2.25. INFLUENCING THE EMPLOYER/ CONSULTANT

- 2.25.1. No Bidder shall contact the Employer/Consultant (if appointed by theEmployer) on any matter relating to its bid, from the time of the opening ofbids to the time the contract is awarded.
- 2.25.2. Any effort by a Bidder to influence the Employer/Consultant in the Employer's bid evaluation, bid comparison or contract award decisions mayresult in rejection of the Bidder's bid.

#### 2.26. EMPLOYER'S RIGHT TO ACCEPT / REJECT ANY BID

- 2.26.1. The Employer reserves the right to accept or reject any bid, and to annul the bid processand reject all bids at any time prior to award of contract,



without thereby incurring any liability to the affected Bidder or Bidders or any obligation to inform the affected Bidder or Bidders of the grounds for the Employer's action.

## 2.27. AWARD OF CONTRACT

2.27.1. The Successful Bidder shall not be entitled to seek any deviation from the Bid Document, and its Clarifications/ Amendments by the Employer (if any).

## 2.28. LETTER OF AWARD (LOA)

2.28.1. Letter of Awards (LOA) shall be awarded to the Bidder whose bid has been determined to be substantially responsive and having the lowest cost per kWh after evaluation of the bid as per the methodology mentioned at Clause No 2.23. The successful Bidder shall be required to confirm its unequivocal acceptance within seven (07) days from the date of issue of Letter of Award. The LOA will constitute the formation of the contract and will be considered for all purposes of execution of contract provisions till such time the signing of the Contract Agreement.

## 2.29. SIGNING OF THE CONTRACT AGREEMENT

2.29.1. The Contract Agreement(s) will be signed unit-wise in two (2) originals on non-judicial stamp paper of appropriate value within 28 (twenty-Eight) days of issue of Letter of Awards and the Contractor shall be provided with one signed copy of original Agreement and the other will be retained by the Employer.

2.29.2. Subsequent to signing of the Contract(s), the Contractor at his own cost shall provide the Employer with at least fifteen (15) copies of Agreements (Hard Bound) within thirty (30) days after signing of the Contracts along with its soft copy.

## 2.30. CORRUPT OR FRAUDULENT PRACTICES

2.30.1. The Employer requires the Bidders to observe the highest standard of ethics during the procurement and execution of the Contract. In pursuance of this policy, the Employer defines, for the purposes of this provision, the terms set forth below as follows:

- i. **"Corrupt practice"** means the offering, giving, receiving or soliciting of anything of value to influence the action of a public official in the procurement process or in contract execution; and
- ii. **"Fraudulent practice"** means a misrepresentation of facts in order to influence a procurement process or the execution of a contract to the detriment of the owner, and includes collusive practice among Bidders (prior to or after bid submission) designed to establish bid

prices at artificial non-competitive levels and to deprive the owner of the benefits of free and open competition;

- iii. **“Collusive practice”** means a scheme or arrangement between two or more Bidders, with or without the knowledge of the Owner, designed to establish bid prices at artificial, non-competitive levels.
- iv. **“Coercive Practice”** means harming or threatening to harm, directly or indirectly, persons or thereto influence their participation in the procurement process or affect the execution of a contract.

2.30.2. The Employer will reject a proposal for award if it determines that the Bidder recommended for award has engaged in Corrupt or Fraudulent or Collusive or Coercive practices in competing for the contract in question.

2.30.3. The Employer will declare a Bidder ineligible, either indefinitely or for a stated period of time, to be awarded a contract if it at any time determines that the firm has engaged in Corrupt or Fraudulent or Collusive or Coercive practices in competing for, or in executing, a contract of the Employer.

## 2.31. IMMUNITY TO GOVERNMENT OF INDIA AND GOVERNMENT OF MAHARASHTRA.

2.31.1. It is expressly understood and agreed to by and between the Bidder and MAHAPREIT that MAHAPREIT is entering into this contract solely on its own behalf and not on behalf of any other person or entity. In particular, it is expressly understood and agreed that the Government of India or Government of Maharashtra is not a party to this contract and has no liabilities, obligations or rights hereunder.

2.31.2. It is expressly understood and agreed that MAHAPREIT is an independent legal entity with power and authority to enter into contracts solely in its own behalf under the applicable laws of India or Government of Maharashtra and general principles of contract law. The Bidder expressly agrees, acknowledges and understands that MAHAPREIT is not an agent, representative or delegate of the Govt. of India. It is further understood and agreed that the Govt. of India or Government of Maharashtra is not and shall not be liable for any acts, omissions and commissions, breaches or other wrong arising out of the contract. Accordingly, the Bidder hereby expressly waives, release and forgoes any and all actions or claims including cross, impleader, claims or counter claims against the Govt. of India or Government of Maharashtra arising out of this contract and covenants not to sue the Govt. of India or Government of Maharashtra as to any manner, claim cause of action or thing what so ever arising of or under this Agreement.

## 2.32. ADOPTION OF INTEGRITY PACT

2.32.1. In order to ensure transparency, equality and competitiveness in its procurement, MAHAPREIT has decided to adopt Integrity Pact. The



Integrity Pact (IP) envisages an agreement (As per Proforma annexed at **Attachment-4**) between the prospective Bidders/ contractors and the Employer committing the person(s)/ official(s) of both the parties, not to exercise any corrupt influence on any aspect of the contract. Towards implementation on Integrity Pact, an MoU along with Integrity Pact Programme has already been signed between 'MAHAPREIT' And 'Transparency International India' on 5<sup>th</sup> January, 2011.

- 2.32.2. Further, this Integrity Pact Programme is also applicable to subsidiaries of MAHAPREIT or MPBCDC LTD.
- 2.32.3. All Applicants shall enter into an Integrity Pact (to be executed on plain paper) with the Employer at the time of submission of their Bids. Only those Bidders who have entered into Integrity Pact with the Employer shall be eligible to participate in the bidding process. Entering into Integrity Pact as per Proforma provided in the Section Forms & Procedure is a basic qualifying requirement.
- 2.32.4. The Integrity Pact digitally signed on behalf of the Employer is provided as Attachment- 4 in Section-V: BRS & Annexures. The Integrity Pact shall be downloaded, printed and signed by the Applicant and the hard copy shall be submitted.
- 2.32.5. Successful Bidder shall submit duly executed Integrity pact on Non-Judicial Stamp paper of appropriate value prior to signing of Contract Agreement.
- 2.32.6. In order to deal with any grievance (s)/ dispute (s) and to oversee implementation and effectiveness of the Integrity Pact Programme pertaining to this Notice Inviting Tender, Bidder(s) may refer the same to Independent external monitor (IEMs).
- 2.32.7. All pages of the Integrity Pact duly signed by authorized representatives of the Bidder and duly witnessed shall be submitted along with their Bid in accordance with NIT. Failure to submit the original signed copy of the Integrity Pact by the Bidder shall lead to outright rejection of the Bid.

### 2.33. RESTRICTIONS IMPOSED BY GOVT OF INDIA

- 2.33.1. Any Bidder from a country which shares a land border with India will be eligible to bid in this tender only if the Bidder is registered with the Competent Authority specified in Annexure-I of Ministry of Finance, Government of India order no F. No. 6/18/2019-PPD dated 23.07.2020 and various amendment/clarification issued in this regard. The Bidders for the purpose of compliance and its procedure for registration from Competent Authority etc. The Bidder has to submit the undertaking as per **Attachment -16** regarding compliance of above-mentioned order. In case the undertaking given by the Bidder whose tender has been accepted by the Employer is found false at the later stage, this would be a ground for immediate termination and further legal action shall be taken in accordance with law.



## 2.34. INELIGIBILITY FOR PARTICIPATION IN RE-TENDER

- 2.34.1. If a Bidder after opening of tenders where EMD is NIL/not applicable or exempted for such Bidders as per policy guidelines of Government of India, withdraws or modifies its offer within the validity period of the offer, then such Bidder shall be treated as ineligible for future tenders issued by MAHAPREIT for the period of 01 year from the date of default as notified by MAHAPREIT.
- 2.34.2. If a Bidder after having been issued the Letter of Award of the package where EMD is NIL/Not applicable or exempted for Bidder as per policy guidelines of Govt. of India, either does not accept the Letter of Award within stipulated time or does not sign the Contract Agreement or does not submit an acceptable Contract Performance Security as stipulated in CC clause 3.48, then such Bidder shall be treated as ineligible for future tenders issued by MAHAPREIT for the period of 01 year from the date of default as notified by MAHAPREIT.

**\*\*\*\*\*END OF SECTION\*\*\*\*\***



## **SECTION – III**

# **CONDITIONS OF CONTRACT (CC)**



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### 3.1. DEFINITIONS

**"ACT"** or **"ELECTRICITY ACT, 2003"** shall mean the Electricity Act, 2003 and include any modifications, amendments and substitution from time to time;

**"AFFILIATE"** shall mean a company that, directly or indirectly,

- i. controls, or
- ii. is controlled by, or
- iii. is under common control with, a company developing a Project or a Member in a Consortium developing the Project and control means ownership, directly or indirectly, of more than 50% (fifty percent) of the voting shares of such Company or right to appoint majority Directors;

**"APPLICABLE LAW"** shall mean the Electricity Act 2003 and the Rules and Regulations made thereunder from time to time along with amendments thereto and replacements thereof and any other Law pertaining to electricity including regulations framed by the Appropriate Commission or Central Electricity Authority;

**"APPROPRIATE COMMISSION"/" COMMISSION"/" MERC"** shall mean the Maharashtra Electricity Regulatory Commission;

**"ARRAY"** means a collection of electrically connected photovoltaic (PV) modules;

**"ARRAY CURRENT"** means the electrical current produced by a PV array when it is exposed to sunlight;

**"AUTHORIZED REPRESENTATIVE"** shall mean any authorized personnel of the Employer or the contractor to perform the duties and obligations of the Contract as the context may require

**"BACKUP METER"** means the meter installed, operated and maintained by the Solar Power Company, which shall be connected to the same core of the current transformer (CT) and voltage transformer (VT) to which the Main Meter is connected and shall be used for accounting and billing of electricity in case of failure/repair/maintenance of Main Meter;

**"BID"** shall mean the Techno Commercial bid and the Price bid submitted by the Bidder along with all documents/credentials/attachments annexure etc., in response to this NIT, in accordance with the terms and conditions hereof

**"BIDDER"** shall mean Bidding Company (including a foreign company) or a Bidding Consortium submitting the Bid. Any reference to the Bidder includes Bidding Company/ Bidding Consortium, Member of a Bidding Consortium including its successors, executors and permitted assigns and Lead Member of the Bidding Consortium jointly and severally,



as the context may require; foreign companies participating in the bidding process shall be registered as companies as per the rules of their country of origin;

**"BIDDING CONSORTIUM" or "CONSORTIUM"** shall refer to a group of Companies that have collectively submitted the response in accordance with the provisions of this RfS under a Consortium Agreement, who shall be responsible for ensuring the completion of all the Projects and the successful fulfilment of all the rights and performance of all the duties and obligations of such Consortium;

**"BIDDING PROCESS"** shall mean the process adopted by MAHAPREIT for awarding of the contract including but not restricted to inviting response to EOI, inviting Bids, selecting Solar Power Company and adopting the terms and conditions stated in the contract;

**"BID DEADLINE"** shall mean the last date and time for submission of Bid in response to this RFP;

**"BOM"** means the Bill of Materials;

**"BUSINESS DAY"** shall mean with respect to Parties, a day other than Sunday or a statutory holiday, on which the banks remain open for business in the State of Maharashtra;

**"BYPASS DIODE"** means a diode connected across one or more solar cells in a photovoltaic module such that the diode will conduct if the cell(s) become reverse biased. Alternatively, diode connected anti- parallel across a part of the solar cells of a PV module. It protects these solar cells from thermal destruction in case of total or partial shading of individual solar cells while other cells are exposed to full light;

**"BOUGHT OUT ITEMS"** shall mean the items purchased by the Contractor for the purpose of supply as covered under Contract Agreement;

**"CAPACITY UTILIZATION FACTOR" OR "CUF"** shall be based on Contracted Capacity as per respective site location and shall have the same meaning as provided in MERC (Terms and Conditions for Determination of RE Tariff) Regulations, 2010 as amended from time to time;

*For illustration, CUF shall be calculated based on the annual energy injected and metered at the Delivery Point. In any Contract Year, if 'X' MWh of energy has been metered out at the Delivery Point for 'Y' MW Project capacity,  $CUF = (X \text{ MWh} / (Y \text{ MW} * 8766)) * 100\%$ ;*

**"CHARTERED ACCOUNTANT"** shall mean 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.



*For bidders incorporated in countries other than India, "Chartered Accountant" shall mean a person or a firm practicing in the respective country and designated/ registered under the corresponding Statutes/ laws of the respective country;*

**"COMMERCIAL OPERATION DATE (COD) / SCHEDULED COD"** shall have the same meaning as defined in the Contract;

**"COMMISSIONING"** shall have the same meaning as defined in the Contract;

**"COMPANY"** shall mean a body corporate incorporated in India under the Companies Act, 1956 or the Companies Act, 2013, as applicable

**"CC"** shall mean the Conditions of the Contract under which the current project is executed/operated;

**"CONSENTS, CLEARANCES AND PERMITS"** shall mean all authorizations, licenses, approvals, registrations, permits, waivers, privileges, acknowledgements, agreements, or concessions required to be obtained from or provided by any concerned authority for the purpose of setting up of the SPP for supply of power;

**"CONTRACT/ CONTRACT AGREEMENT/ AGREEMENT"** shall mean the Agreement entered into between the Employer and the Contractor signed by the parties including all attachments and appendices thereto and all documents incorporated by reference therein.

**"CONTRACT DOCUMENT"** shall mean collectively the documents listed in Clause 3.3 including any amendments thereto.

**"CONTRACTOR/EPC CONTRACTOR"** means the successful bidder whose bid to perform the Contract has been accepted by the Employer for issue of the Letter of Award and is named as such in the Contract Agreement and includes the legal Successors or permitted assigns of the Contractor.

**"CONTRACTOR'S EQUIPMENT"** means all Plant, facilities, equipment, machinery, tools, apparatus, appliances or things of every kind that are to be provided by the Contractor and required in or for installation, completion of the Facilities and maintenance thereof, but does not include Plant and Equipment, or other things intended to form or forming part of the Facilities.

**"CONTRACT PRICE"** means the firm sum specified in the Contract Agreement, subject to such additions and adjustments thereto or deductions therefrom, as may be made pursuant to the Contract.

**"CONTRACT PERIOD"** shall mean the period beginning from the Effective Date and ending on the immediately succeeding 31st March and thereafter each period of 12 months beginning on 1st April and ending on 31st March provided that:



*In the financial year in which the Scheduled Commissioning Date would occur, the Contract Year shall end on the date immediately before the Scheduled Commissioning Date and a new Contract Year shall commence once again from the Scheduled Commissioning Date and end on the immediately succeeding 31<sup>st</sup> March, and thereafter each period of 12 (Twelve) Months commencing on 1<sup>st</sup> April and ending on 31<sup>st</sup> March, and provided further that the last Contract Year of this Agreement shall end on the last day of the Term of this Contract;*

**"CONTRACT YEAR"** shall have the same meaning as defined in the Contract;

**"CONTROL"** shall mean the ownership, directly or indirectly, of more than 50% (fifty percent) of the voting shares of such Company or right to appoint majority Directors;

**"CONTROLLING SHAREHOLDING"** shall mean more than 50% of the voting rights and paid-up share capital in the Company/ Consortium;

**"CRYSTALLINE SILICON"** means a type of PV cell made from a single crystal or polycrystalline and/or Monocrystalline slice of silicon;

**"DAY"** shall mean calendar day;

**"DELIVERY POINT"** shall mean the 220 kV MSETCL at Ghatnandre;

**"DETAILED DRAWINGS"** means the execution drawings, which will be furnished by the Solar Power Company for execution of the work that will form part of the Contract;

**"DRAWINGS"** means collectively all the accompanying general drawings as well as all detailed drawings, which may be used from time to time;

**"DISCOM"** means Power Distribution Company of the state, responsible for distribution of Electrical power in the region and associated activities.

**"DRAWINGS", "PLANS"** shall mean all Drawings or Plans submitted by the Contractor with his Bid, Drawings, Engineering data and Plans submitted by the Contractor during the progress of the work.

**"EFFECTIVE DATE"** shall have the same meaning as defined in the Contract;

**"EFFICIENCY"** means the ratio of output power (or energy) to input power (or energy), expressed in Percent;

**"ELECTRICAL GRID"** means an integrated system of electricity distribution, usually covering a large area;

**"EMPLOYER'S REPRESENTATIVE"** shall mean any person, persons or consulting firm appointed by the Employer to supervise the work, inspect and examine workmanship and test materials/equipment to be supplied;



**"ENGINEER-IN-CHARGE" OR "EIC"** means the person appointed by the Employer to perform the duties delegated by the Employer;

**"FACILITIES"** shall mean all Plant and Equipment, Tools and Works to be supplied, erected, tested and commissioned as well as pre-commissioning, commissioning and all related services including Performance Guarantee Test to be carried out within thirty (30) days of the COD, in accordance with the contract by the Contractor under this Contract;

**"FILL FACTOR (FF)"** means for an I-V curve, the ratio of the maximum power to the product of the open- circuit voltage and the short-circuit current. Fill Factor is a measure of the "squareness" of the I-V curve;

**"FINANCIAL BID"** shall mean Envelope II of the Bid, containing the price offered to MAHAPREIT by the Bidder as per this RFP;

**"FINAL ACCEPTANCE TEST"** shall have the same meaning as defined in the Contract;

**"FINANCIAL YEAR" or "FISCAL YEAR"** runs from April 1 of the any year through March 31 of the next year;

**"FINANCIALLY EVALUATED ENTITY"** shall mean the company which has been evaluated for the satisfaction of the financial requirement set forth in Clause 1.4.2 of SECTION -I of this RFP;

**"FREQUENCY"** means the number of repetitions per unit time of a complete waveform, expressed in Hertz (Hz);

**"GRID"** means term used to describe an electrical utility distribution network;

**"GRID CODE" / "IEGC" / "STATE GRID CODE"** shall mean the Grid Code specified by the Central Electricity Regulatory Commission under Clause (h) of Sub-section (1) of Section 79 of the Electricity Act and/or the State Grid Code as specified by the Maharashtra State Electricity Commission, referred under Clause (h) of Sub-section (1) of Section 86 of the Electricity Act 2003, as applicable;

**"GRID CONNECTED PV SYSTEM"** means a PV system in which the PV array acts like a central generating plant, supplying power directly to the grid;

**"GRID INTERACTIVE"** means a grid connected system which can feed in power to the grid as per the relevant Indian grid standards;

**"GOODS AND SERVICE TAX" OR "GST"** shall mean taxes or cess levied under the Central Goods and Services Tax Act, Integrated Goods and Services Tax Act, Goods and Services Tax (Compensation to States) Act and various State/Union Territory Goods and Services Tax Laws and applicable cesses, if any under the laws in force (hereinafter



referred to as relevant GST Laws) w.e.f. 01.07.2017, which shall be fully complied with by Bidders;

**"GOVERNMENT"** shall mean the Government of Maharashtra or the Government of India, as the case may be;

**"GTP"/ "GUARANTEED TECHNICAL PARAMETERS"** shall mean a document confirming all technical and physical parameters of a component or system, which shall be stamped and signed by the manufacturer / supplier of the particular item and the Bidder;

**"IEC"** means International Electro technical Commission; is the world's leading organization that prepares and publishes International Standards for all electrical, electronic and related technologies;

**"INDIAN GOVERNMENTAL INSTRUMENTALITY"** shall mean the Government of India, Governments of state(s) of Maharashtra state in India, where the Solar Power Company, MAHAPREIT and the Solar Power Plant are located and any ministry, department, board, authority, agency, corporation, commission under the direct or indirect control of Government of India or any of the above state Government(s) or both, any political sub-division of any of them including any court or Appropriate Commission(s) or tribunal or judicial or quasi-judicial body in India but excluding the Solar Power Company and MAHAPREIT;

**"INSOLATION"** means the solar radiation incident on an area over time, equivalent to energy and usually expressed in kilowatt-hours per square meter;

**"INSPECTOR"** shall mean the Employer or any other person nominated by the Employer from time to time, to inspect the equipment, stores and the works under the Contract and/or the duly authorized representative of the Employer;

**"INSTALLATION SERVICES"** means all those services ancillary to the supply of the Plant and Equipment for the Facilities, to be provided by the Contractor under the Contract; e.g., transportation and provision of marine or other similar insurance (s), inspection, expediting, site preparation works (including the provision and use of Contractor's Equipment and the supply of all use structural and construction materials required), installation including civil and allied works etc., testing, pre-commissioning, commissioning, PG Test, operation, maintenance, the provision of operations and maintenance manuals, training of Employer's Personnel etc.

**"INVERTER"/ "POWER CONDITIONING UNIT (PCU)"/ "POWER CONDITIONING SYSTEM (PCS)"** means in a PV system, an inverter converts DC power from the PV array to AC power compatible with the utility and AC loads;



**"IRRADIANCE"** means the solar power incident on a surface; usually expressed in kilowatts per square meter. Irradiance multiplied by time equals Insolation;

**"JUNCTION BOX"** means a PV generator junction box is an enclosure on the module where PV strings are electrically connected and where protection devices can be located, if necessary;

**"KV"** shall mean Kilovolts;

**"KILOWATT (KW)"** means one thousand watts; a unit of power;

**"KILOWATT HOUR (kWh)"** means one thousand watt-hours, a unit of energy. Power multiplied by time equals energy;

**"LABOURER"** shall mean all categories of labour engaged by the Contractor, his sub-Contractors and his piece workers for work in connection with the execution of the work covered by the specifications. All these labourers will be deemed to be employed primarily by the Contractor.

**"LETTER OF AWARD (LOA)"** means the letter from MAHAPREIT conveying its acceptance of the bid submitted by the Successful Bidder subject to such reservations/conditions as may have been stated therein;

**"MAXIMUM POWER POINT (MPP)"** means the point on the current-voltage (I-V) curve of a module under illumination, where the product of current and voltage is maximum;

**"MAXIMUM POWER POINT TRACKER (MPPT)"** means the means of a power conditioning unit that automatically operates the PV-generator at its MPP under all conditions;

**"MANUFACTURER'S WORKS" / "CONTRACTOR'S WORKS"** shall mean the place of work used by the manufacturer, the Contractor or the Sub-Contractors for the performance of the work;

**"MEDA"** means Maharashtra Energy Development Agency, assistance to state and central govt to promote and develop new and renewable sources of energy and technologies and to promote and implement energy conservation;

**"MODULE"** means the smallest replaceable unit in a PV array. It is an integral, encapsulated unit containing a number of PV cells;

**"MONTH"** shall mean a calendar month;

**"MSEDCL"/ "MAHADISCOM"** shall mean Maharashtra State Electricity Distribution Company Limited;



**"MSETCL"/ "MAHATRANSCO"** shall mean Maharashtra State Electricity Transmission Company Limited;

**"MW"** shall mean Megawatt;

**"NABL"** shall mean National Accreditation Board for Testing and Calibration Laboratories, an autonomous body under the aegis of Department of Science and Technology, Government of India;

**"NEWLY INCORPORATED COMPANY"** shall mean a company which has been in existence for less than a year;

**"NET WORTH"** shall mean the Net-Worth as defined section 2 of the company Act, 2013;

**"ONSHORE SUPPLIES/SERVICES"** shall mean indigenous supplies/services;

**"OFFSHORE SUPPLIES/ SERVICES"** shall mean supplies/services procured from outside India;

**"OPERATION AND MAINTENANCE"/ "O&M"** shall have the same meaning as defined in the Contract;

**"OPERATIONAL ACCEPTANCE"** means the acceptance by the Employer of the Facilities (or any part of the Facilities where the Contract provides for acceptance of the Facilities in parts), which certifies the Contractor's fulfillment of the Contract in respect of Performance Guarantee Test of the Facilities;

**"OPEN CIRCUIT VOLTAGE"** means the maximum voltage produced by an illuminated photovoltaic cell, module, or array with no load connected. This value will increase as the temperature of the PV material decreases;

**"PARENT COMPANY/HOLDING COMPANY"** shall mean a company that holds at least fifty one percent (51%) of the paid-up equity capital directly or indirectly in the Bidding Company or in the Member of a Bidding Consortium, as the case may be;

**"PARTY"** shall mean the Employer or the Contractor, as the context requires;

**"PERSON"** shall include firms, companies, corporations and associations or bodies of individuals, whether incorporated or not. 'Singular' or 'masculine' includes 'plural' or 'feminine' and vice-versa in their respective context;

**"PEAK WATT (Wp)"** means the amount of power a photovoltaic module will produce at standard test conditions (normally 1000 W/m<sup>2</sup> and 25° cell temperature);

**"PHOTOVOLTAIC SYSTEM"** means an installation of PV modules and other components designed to produce power from sunlight and meet the power demand for a designated load or feed energy to the grid;





**"PLANT, EQUIPMENT, MACHINERY, MATERIAL"** shall mean permanent plant, equipment, machinery, apparatus, system, articles and things of all kinds to be provided and incorporated in the facilities by the Contractor under this Contract including the spare parts, tools and tackles to be supplied by the Contractor but does not include Contractor's equipment;

**"POWER PROJECT" or "PROJECT"** shall mean the Solar power generation facility comprising single unit at identified location, having multi points of injection into the grid at Interconnection/ Delivery/ Metering Point. The Project shall include all units and auxiliaries such as water supply, treatment or storage facilities, bay(s) for transmission system in the switchyard, dedicated transmission line up to the Delivery Point and all the other assets, buildings/structures, equipment, plant and machinery, facilities and related assets required for the efficient and economic operation of the power generation facility, whether completed or at any stage of development and construction or intended to be developed and constructed for the purpose of supply of power to MSEDCL;

**"POWER FACTOR"** means the Cosine of the phase angle between the voltage and the current waveforms in an AC circuit. This is used as a designator for inverter performance. A power factor of 1 indicates current and voltage are in phase and power is equal to the product of Volt-Amperes (no reactive power);

**"PRICE BID"** shall mean the Total Bid price per Wp quoted by the bidder for setting up the Solar PV Project inclusive of all the taxes & duties;

**"PROJECT CAPACITY"** shall mean the maximum AC capacity at the delivery point that can be scheduled on which the Contract shall be signed;

**"PROJECT COMPLETION"** shall have the same meaning as defined in the Contract;

**"PROJECT COMMISSIONING"** shall mean that the Project will be considered as commissioned if all equipment as per rated project capacity has been installed and energy has flown into grid, in line with the Commissioning procedures defined in the RfS;

**"PMC"/ "PROJECT MANAGEMENT CONSULTANT/ OWNER'S ENGINEER"** shall mean the agency and/ or person(s) so designated by MAHAPREIT to overlook, supervise & monitor project work, approve the drawings, report & witness for various testing, inspection of material at factory & site, check the Quality of work and to certify the work of the Solar Power Company's work so as to ensure compliance with the project's scope of work and terms of the Contract;

**"PROJECT MANAGER / SITE - IN - CHARGE"** means the Project Manager appointed by MAHAPREIT or its duly authorized representative to direct, supervise and be in-charge of the works for the purpose of the Contract;



**"PYRANOMETER"** means an instrument used for measuring global solar irradiance;

**"QUALIFICATION REQUIREMENTS"** shall mean the qualification requirements as set forth in Clause 1.4 section-I of this RFP;

**"RATED MODULE CURRENT"** means the current output of a PV module measured at standard test conditions of 1,000 w/m<sup>2</sup> and 25°C cell temperature;

**"REACTIVE POWER"** means the sine of the phase angle between the current & voltage waveforms in an AC system;

**"RfS DOCUMENT"** shall mean the bidding document issued by MAHAPREIT including all attachments, clarifications and amendments thereof vide RfS no: MAHAPREIT/SEP-02/06-23;

**"REQUEST FOR PROPOSAL (RFP)"** means this entire document issued to the Bidders, which gives out Instruction to Bidders, Tender Specification and any other addendum/revisions issued thereof.

**"REVISED SCHEDULED COD"** shall have the same meaning as defined in the Contract.

**"RFP"** shall mean this Request for Proposal dated 07.12.2022 along with all formats and RFP Documents attached hereto and shall include any modifications, amendments alterations or clarifications thereto.

**"RFP DOCUMENTS"** shall mean the following documents to be entered into by the parties to the respective agreements in connection with the supply of power:

- i. Contract Agreement
- ii. Amendment issue on pre bid
- iii. Various amendment subsequent to pre bid
- iv. Annexures
- v. Pre bid query

**"SCHEDULED COMMISSIONING DATE" or "SCD"** shall mean means 12 (Twelve) months or 380 days whichever is later, from the date of handing over of project land proposed for 50 MW<sub>AC</sub> Solar Power Project. Partial Commissioning of the Project would be allowed subject to land availability and duration for SCD shall be computed based on the date of NTP issued by the MAHAPREIT;

**"SHORT CIRCUIT CURRENT"** means the current produced by an illuminated PV cell, module, or array when its output terminals are shorted;

**"SITE"** means the land on, under in or through which the works are to be executed or carried out and such lands as may be agreed upon between MAHAPREIT and the Solar Power Company as being reasonable and necessary for carrying out of the works;



**"SPECIFICATIONS"** means collectively all the terms and stipulations contained in this document including the conditions of contract, technical provisions and attachments thereto and list of corrections and amendments.

**"STANDARD TEST CONDITIONS"** means conditions under which a module is typically tested in a laboratory: (1) Irradiance intensity of 1000 W/M<sup>2</sup> (2) AM1.5 solar reference spectrum and (3) cell (module) temperature of 25°C.

**"STRING"** means a number of modules or panels interconnected electrically in series to produce the operating voltage required by the load.

**"SOLAR PV PROJECT"** shall mean the Solar Photo Voltaic Power Project that uses sunlight for direct conversion into electricity through Photo Voltaic Technology;

**"SUB-CONTRACTORS/ SUB-VENDORS"** refers to a party or parties having direct contract with the Contractor and to whom any part of the contract has been sublet by the Contractor without any waiver to terms and conditions and responsibilities agreed with MAHAPREIT;

**"SUB-SYSTEM"** means any one of several components in a PV system (i.e., Array, controller, batteries, inverter, load);

**"SUBSTATION"** shall mean a point where Solar PV Project shall connect to a Transmission System which shall be constructed and maintained by the SPD to get connected to the Delivery Point. The voltage level for such common line shall be 132 kV. Further, the metering of the power shall be done at the injection point, i.e., the Delivery Point. The voltage level of transmission system of up to the substation shall be at 220 kV;

**"SUCCESSFUL COMPLETION OF O&M PERIOD"** means contractor shall fulfil following conditions;

- i. The actual Units (kWh) generated during 5 years of the operation and maintenance is expected to be more than or equal to Quoted Electrical Energy Generation (QEEG) in the bid offer by the bidder.
- ii. EPC Contractor shall demonstrate that Solar Plant Generation at the end of 5<sup>th</sup> year is more than quoted 6<sup>th</sup> yearly guaranteed generation quoted for contracted capacity of 50 MW<sub>AC</sub>;

**"SUCCESSFUL BIDDER/CONTRACTOR"** shall mean the Bidder whose Bid has been accepted by MAHAPREIT and to whom Letter of Award (LOA) has been issued and shall include such successful Bidder's legal representatives, successors and permitted assigns;

**"SUN PATH DIAGRAM"** means graphical representation of the Sun's height and



azimuth;

**"SYSTEM OPERATING VOLTAGE"** means the Array output voltage under load. The system operating voltage is dependent on the load or batteries connected to the output terminals;

**"TESTS ON COMPLETION"** shall mean all such tests as are prescribed by the specification to be made by the Contractor to the satisfaction of the MAHAPREIT before the plant and equipment are taken over by the MAHAPREIT and this also includes those tests not specifically mentioned in the specification but required under various BIS codes and relevant Applicable Laws. The Contractor has to show the report to the MAHAPREIT on the test site conditions;

**"TILT ANGLE"** means the angle of inclination of a solar collector measured from the horizontal;

**"TRACKING ARRAY"** means a PV Array that follows the path of the Sun. This can mean one-axis, East to West daily tracking or two-axis tracking, where the Array follows the Sun in azimuth and elevation;

**"TRANSFORMER (STEP-UP)"** means a transformer that converts the generator's low-voltage electricity to higher voltage levels for transmission to the grid or load center;

**"UNINTERRUPTED POWER SUPPLY (UPS)"** means the designation of a power supply providing continuous uninterruptible service. The UPS will include batteries;

**"UTILITY (GRID) INTERACTIVE INVERTER"** means an inverter that can function only when tied to the utility grid, and uses the prevailing line-voltage frequency on the utility line as a control parameter to ensure that the PV system's output is fully synchronized with the utility power;

**"VENDOR'S CREDENTIALS"** shall mean, unless specifically mentioned otherwise, the copies of Purchase Orders / Supply Invoices or Chartered Accountant's certificate clearly stating the extent of meeting eligibility criteria;

**"WATT (W)"** means the unit of electrical power. The power developed when a current of one ampere flows through a potential difference of one volt;

**"WATT HOUR (Wh)"** means a unit of energy equal to one watt of power connected for one hour;

**"WEEK"** shall mean calendar week;

**"WORKING DAY"** shall mean the part of the day devoted or allotted to work;



The terms and expressions not herein defined shall have the same meaning as assigned to them in the relevant Acts and/or Regulations as the case may be.

### 3.2. GENERAL USAGE OF LANGUAGE AND INTERPRETATION

- 3.2.1. Conditions of Contract shall be read in conjunction with the Notice Inviting Tender (NIT), Instructions to Bidders (ITB), Technical Specifications, Quality Assurance plan and any other document forming part of this contract, wherever the context so requires.
- 3.2.2. Words imparting 'persons' shall include firms, companies, Employers and association or body of individuals, whether incorporated or not.
- 3.2.3. Any error in description, quantity in Bill of Quantities or any omission there from shall not vitiate the Contract or release the Contractor from execution of the whole or any part of the Works comprised therein according to drawings and Specifications or from any of his obligations under the Contract.
- 3.2.4. **Headings, Marginal notes and captions:** The Headings, Marginal Notes and Captions to any Clause of the Contract shall not limit, alter or affect the meaning of the specifications or conditions of bidding. These have been provided for the facility of references only and shall not affect or control the construction of the Contract
- 3.2.5. **Language and measurement:** All documents pertaining to the Contract, including specifications, schedules, notices, correspondences, operation and maintenance instructions, drawings or any other documents shall be written in English language. The Metric system of measurement shall be used exclusively in the Contract.
- 3.2.6. Unless otherwise specifically mentioned, the references of Clause No given under various clauses shall be deemed to be pertaining to this Bid Documents.

### 3.3. CONTRACT DOCUMENT

- 3.3.1. The term Contract document shall mean and include the following (including subsequent amendments, if any) which shall essentially form an integral part of the contract.
  - i. Contract Agreement
  - ii. Letter of Award (LoA), duly accepted by bidder together with its amendments, if any
  - iii. Bid Document including subsequent amendments/clarifications, if any.
  - iv. Contractor's Bid Proposal along with Bid Response Sheets, Annexure etc.
  - v. Final Approved Quality Assurance Plans for manufacturing and site/field activities for all major/critical items
  - vi. Integrity Pact
  - vii. Activity Chart/Project Schedule (Detailed schedule of activities breakup



under major activities, sub-activities and sub-sub-activities with specified timeline and highlighted critical activities which may impact the project timeline.

viii. Manpower Chart

ix. Any other documents forming part of the Contract

3.3.2. All the aforesaid documents shall form an integral part of the Contract, in so far as the same or any part thereof conform to the Bid Documents and what has been specifically agreed to by the Employer and brought out in Letter of Award issued by the Employer. Any matter inconsistent therewith, contrary or repugnant thereto or any deviation taken by the Contractor in its Bid but not agreed to specifically by the Employer in its Letter of Award shall be deemed to have been withdrawn by the Contractor.

3.3.3. In case of any contradiction in any of the terms & conditions to the extent that the two provisions cannot co-exist, the following shall prevail in order of precedence.

- a) Letter of Award
- b) Conditions of Contract
- c) Technical Specifications
- d) Instructions to Bidder
- e) Any other document

#### 3.4. USE OF CONTRACT DOCUMENTS AND INFORMATION

3.4.1. The Contractor, without the Employer's prior written consent, shall not disclose the Contract, or any provisions thereof, or any specification, plan, drawing, pattern, sample or information furnished by or on behalf of the Employer in connection therewith, to any person other than the person employed by the Contractor in the performance of the Contract. Disclosures to any such employed person shall be made in confidence and shall extend only as far as may be necessary for purposes of such performance.

3.4.2. The Contractor, without the Employer's prior written consent, shall not make use of any document or information enumerated in various Contract documents except for the purpose of performing the Contract.

3.4.3. Any document, other than the Contract itself, enumerated in various Contract documents, shall remain the property of the Employer and shall be returned (in all copies) to the Employer on completion of the Contractor's performance under the contract if so, required by the Employer.

3.4.4. The Contractor shall not communicate or use in advertising, publicity, sales releases or in any other medium, photographs and other reproductions of the works under the Contract or descriptions of the site, dimensions, quantity, quality or other information concerning the works unless prior written permission has been obtained from the Employer.



### 3.5. SCOPE OF THE CONTRACT

- i. The contractor's obligations under the contract shall include Design, Engineering, Supply, Erection, Testing, Commissioning and Comprehensive O&M for Five Years of total 50 MW(AC) of grid connected Solar Power Project in the state of Maharashtra and 05 (five) years comprehensive Operation & Maintenance on turnkey basis completely covering the scope of supply & services and associated activities as described in this Bid Documents.
- ii. All Works to be carried out under this contract shall be in accordance with the requirements, conditions, appendices etc. given in Technical Requirements/ Specifications (Section-V) together with those stated in other Sections/Sub-sections of this Bid Documents, which shall be considered as a part of this volume completely as if bound herewith. Further, all the works to be carried out under the scope should also comply all the technical requirements.
- iii. The Contractor shall, unless specifically excluded in the Contract, perform all such work and/or supply all such items and materials not specifically mentioned in the Contract but that can be reasonably inferred from the Contract as being required for attaining Completion of the Facilities as if such work and/or items and materials were expressly mentioned in the Contract.
- iv. The detailed Scope of Work is given in the Technical Specifications (Section- VI)

### 3.6. CONSTRUCTION OF THE CONTRACT

- 3.6.1. Notwithstanding anything stated elsewhere in the Bid Documents, the Contract to be awarded shall be for entire capacity on a single source responsibility. However, MAHAPREIT may issue the Notice to Proceed on each land parcel of minimum design capacity of block 6-10 MW.
- 3.6.2. A breach in the performance of any of the above contracts mentioned at Clause No 3.6.1 above shall be considered as a breach in performance of the other contracts, which shall confer a right to MAHAPREIT to terminate the other contracts also at the risk and cost of the Contractor without prejudice to other rights, MAHAPREIT may have as per terms & conditions of respective order.
- 3.6.3. Entire responsibility with regard to Design, Engineering, Supply, Erection, Testing, Commissioning and Comprehensive O&M for Five Years of total 50 MW(AC) of grid connected Solar Power Project in the state of Maharashtra will remain with Contractor irrespective of the modality of the contracts and the Contractor shall coordinate all activities for smooth and timely completion of the project in such a manner, as if there has been no split in the scope.

### 3.7. AMENDMENT

No amendment or other variation of the Contract shall be effective unless it is in writing, is dated, expressly refers to the Contract, and is signed by a duly authorized representative of each party hereto.



### 3.8. POWER TO VARY OR OMIT WORK

- v. No alterations, amendments, omissions, additions, subtractions, or variations of the work (hereinafter referred to as "variation") under the contract shall be made by the Contractor except as directed by the Employer.
- vi. If any suggested variations would, in the opinion of the Contractor, if carried out prevent it from fulfilling any of its obligations or guarantees under the Contract, it shall notify the Employer thereof in writing and the Employer shall decide forthwith whether or not the same shall be carried out and if Employer confirms its instruction, the Contractor shall carryout the work as per instructions.
- vii. The differences in cost, if any, occasioned by such variations, shall be added to or deducted from the Contract Price, as the case may be
- viii. In the event of the Employer requiring any variations, reasonable and proper notice shall be given to the Contractor as well, to enable it to make arrangements accordingly, and in cases where goods or materials are already prepared/procured, or any designs, drawings or patterns made or work done that require to be altered, a reasonable sum in respect thereof shall be allowed by the Employer.
- ix. In every case in which the contractor shall receive instructions from the Employer for carrying out any work, which either then or later, will in the opinion of the Contractor involve a claim for additional payment, the Contractor shall as soon as reasonably possible after the receipt of such instructions, inform in writing the Employer of such claim for additional payment.

### 3.9. CONTRACT AGREEMENT

- 3.9.1. The Contract Agreement(s) will be signed unit-wise in two (2) originals on non-judicial stamp paper of appropriate value within twenty-eight (28) days of issue of Letters of Award. Signing of the Contract Agreement will be done at office of MAHAPREIT. The Contract Agreement shall be signed only after Contractor provides Contract performance cum Security Guarantee (CPSG) to the Employer as per information specified in Clause 3.48 of the Bid Documents and completes other activities which are required to be carried out by the contractor prior to signing of Contract Agreement as per the Bid Documents. The format for Contract Agreement is specified in Annexure 1 of Section-V: Bid Response Sheets and Annexures.
- 3.9.2. Unless and until a formal Contract Agreement is prepared and executed, Letter of Award, in conjunction with the Bid Documents will constitute a binding Contract. After signing of the Contract Agreement, 15 (Fifteen) true hard copies of the same shall have to be made by the Contractor and shall be submitted to the Employer along with the soft copy within 30 days from the date of signing of the Contract Agreement.





### 3.10. ASSIGNMENT AND SUBLETTING OF CONTRACT

- 3.10.1. The Contractor shall not assign, sublet or sub-contract any part of the contract without prior specific written approval by the Employer other than to those vendors/sub-contractors already identified/qualified/approved in the contract. Such Assignment/sub-letting/sub- contracting under the contract as above without prior written approval of Employer shall be void. Such approval by the Employer for any of the Subcontractors shall not relieve the Contractor from any of its obligations, duties or responsibilities under the Contract. The contractor shall notify the Employer in writing of all sub contracts awarded under the contract, if not already specified in his bid.
- 3.10.2. In case, the Contractor engages any Sub-Contractor to carry out a part of the work, the Sub- Contractor should have requisite Government License as applicable for carrying out such part of the work.

### 3.11. CONTRACTOR'S VENDORS /SUPPLIERS/ SUBCONTRACTORS

- 3.11.1. Save for any material/minor details/parts of the equipment/services for which origin/makes are identified in the contract, the Contractor shall not procure equipment/services or part thereof for incorporation in his supplies/services from other vendors/suppliers/sub-contractors without applying in writing to the Engineer-in-Charge for his examination and getting his prior written approval thereon. Any change in the vendors/suppliers/sub-contractors already identified in the contract as per Section (IV)-Technical Specification shall also be subject to approval by the Engineer-in-Charge. If the Contractor finds it necessary to have vendors/suppliers/sub- contractors for additional items/materials or to change the already identified (in the contract) vendors/suppliers/subcontractors, the relevant application to the Engineer-in-Charge shall include the experience list of such equipment vendors/suppliers/sub-contractors of such materials/equipment. Any approval by the Employer for any of the vendors/suppliers/sub- contractors of the Contractor shall not relieve the Contractor from any obligation, or responsibility under the contract.
- 3.11.2. The contractor shall furnish, for such bought out items/components, a copy of the Purchase Order without price details but together with detailed purchase specifications, quality plans and delivery conditions to the Employer.

### 3.12. RESPONSIBILITIES OF THE CONTRACTOR

- 3.12.1. The Contractor shall design, procure/ manufacture (including associated purchases and/or subcontracting), install, commission and complete the Facilities, carry out the Operational Acceptance tests and Operation and Maintenance (O&M) of the entire plant for the prescribed period with due care and diligence in accordance with the Contract provisions.

- 3.12.2. The Contractor confirms that it has entered into this Contract on the basis of a proper examination of the data relating to the Facilities provided by the Employer and assessed by himself at the site location, and on the basis of information that the Contractor could have obtained from a visual inspection of the Site (if access thereto was available) and of other data readily available to it only after proper due diligence relating to the Facilities prior to bid submission. The Contractor acknowledges that any failure to acquaint itself with all such data and information shall not relieve its responsibility for properly estimating the difficulty or cost of successfully performing the Facilities.
- 3.12.3. The Contractor shall acquire, on behalf of Employer, in the name of the Employer, all permits, approvals and/or licenses from all local, state or national government authorities or public service undertakings in the country/state where the Site is located that are necessary for the setting up of the plant mentioned under the Contract. In this regard, any document required from Employer shall be intimated by the Contractor to the Employer at least 21 days prior to submission. Contractor has to ensure safe keeping of the documents and diligent use.
- 3.12.4. The Contractor shall acquire in its name all permits, approvals and/or licenses from all local, state or national government authorities or public service authorities 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 laying down of HT cables/lines as applicable, and entry permits for all imported Contractor's Equipment. The Contractor shall acquire all other permits, approvals and/or licenses that are not the responsibility of the Employer under Clause No 3.13 of this Bid Documents hereof and that are necessary for the Performance of the Contract.
- 3.12.5. Contractor shall also seek for any exemption applicable for the project as per the orders released from GOI time to time. In this regard, contractor shall be responsible to take all necessary certificates as a proof of exemptions on behalf of Employer. However, all the documents required from Employer, as needed for the process, will be provided by Employer. The demand of such documents shall be made to the Employer at least 10 days in advance.
- 3.12.6. Similarly, contractor shall consider of all the Input Tax Credits (ITC) available to the Facilities or during Operation and Maintenance Contract while quoting its prices as per the provisions of GST Act.
- 3.12.7. 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 Employer from and against any and all liabilities, damages, claims, fines, penalties and expenses of whatever nature



arising or resulting from the violation of such laws by the Contractor or its personnel, including the Subcontractors and their personnel.

- 3.12.8. Unless otherwise specified in the Contract or agreed upon by the Employer and the Contractor, the Contractor shall provide/ deploy sufficient, properly qualified personnel for Erection, Testing, Commissioning and Operation & Maintenance of the Plant; 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 Commissioning, Performance Guarantee Tests/Operational Acceptance Test, all in accordance with the provisions of the bid document within the time specified under Clause No. 3.17 (Timelines) hereof and in the manner thereupon specified in the bid document.
- 3.12.9. The Contractor shall be responsible for the Operation & Maintenance of the Facilities after Commissioning and related operation of the plant till the COD is achieved before proper hand over of the site by contractor.
- 3.12.10. On completion of the work, the Contractor shall inform the Engineer-in-Charge in writing about the Date of Completion and shall request him for a Completion Certificate. No such certificate will be given nor shall the work be considered as completed, until the Contractor has removed from the premises on which the work has been executed, all surplus materials and rubbish, which he may have had possession/generated for the purpose of the execution thereof and the area is fully cleared to the satisfaction of the Engineer-in- Charge and if the Contractor fails to do so on or before the date fixed for completion of the work, the Engineer-in-Charge may do so and may sell such scaffolding and materials as have not been removed by the Contractor and the expenditure so incurred shall be recovered from the Contractor's outstanding dues. The Contractor shall have no claim in respect of any such scaffolding or surplus materials as aforesaid.

### 3.13. RESPONSIBILITIES OF THE EMPLOYER

- 3.13.1. The Employer shall provide all information and/or data to be supplied by the Employer as described in the Scope of Works and Supply by the Employer to the Contractor, except when otherwise expressly stated in the Contract.
- 3.13.2. The Employer shall handover the land to the contractor as per timelines stipulated in bid document.
- 3.13.3. The Employer shall pay fees for all permits, approvals and/or licenses from all local, state or national government authorities or public service authorities in the country where the Site is located for the plant establishment, which such authorities or undertakings require the Employer to obtain them in the Employer's name, are necessary for the execution of the Contract as specified in the Scope of the Bid Document.



3.13.4. If requested by the Contractor and upon Employer's sole discretion, the Employer shall assist the Contractor in obtaining in a timely and expeditious manner all permits, approvals and/or licenses necessary for the execution of the Contract from all local state or national government authorities or public service undertakings that such authorities or undertakings required for the Contractor.

### 3.14. PATENT RIGHTS AND ROYALTIES

3.14.1. The Contractor shall at all-time indemnify MAHAPREIT against all claims which may be made in respect of the plant and machinery for infringement of any right protected by patent, trademark, intellectual Property rights and / or industrial design rights arising from use of the Goods or any part thereof in India and / or other country. Provided always that in the event of any claim in respect of any alleged breach of patent, trademark, intellectual Property rights and / or industrial design rights arising from use of the Goods or any part thereof in India and / or other country made against MAHAPREIT, the same shall be notified to the Contractor and Contractor shall at his own cost either settle such dispute amicably or conduct any litigation that may arise there from.

### 3.15. EFFECTIVENESS OF THE CONTRACT

3.15.1. The contract shall be considered as having come into force from the date of issuance of LOA by MAHAPREIT to the Contractor unless otherwise provided in the Letter of Award

### 3.16. TIME - THE ESSENCE OF CONTRACT

3.16.1. The time and the date of successful completion of scope of work as stipulated in the contract by MAHAPREIT without or with modifications, if any, and so incorporated in the Letter of Award, shall be deemed to be the essence of the contract for all intents and purposes. The Contractor shall so organize his resources and perform his work as to complete it not later than the date agreed to in the Contract.

### 3.17. TIMELINES

3.17.1. All works envisaged in this Contract shall be completed within the time limit specified at Clause No 3.17.2 below with or without modifications, if any, and so incorporated in the Letter of Award and no deviation shall be allowed whatsoever. The Contractor shall so organize his resources and perform his work as to complete it not later than the date agreed to in the timeline schedule. The time for completion of his works contracted for, shall be reckoned from the date of issue of the Letter of Award (LoA) by the Employer unless otherwise provided in the LoA. The Contractor's liability for delay in completion shall be as stipulated under the Clause No. 3.49 (Liquidated Damages for EPC Contract) of Section III: Conditions of Contract of this bid document.

3.17.2. Entire scope of supply and works under this contract shall be completed within the timeline as mentioned below:

<b>Sr. No.</b>	<b>Stage</b>	<b>Reference from Zero Date (ZD) (In Days)</b>
1)	Issuance of Letter of Award by the Employer	ZD
2)	Furnishing of site details by MAHAPREIT for taking up of various testing and design activities and Notice to Proceed by MAHAPREIT for identified Land segment	ZD + 30
3)	Submission of Detailed Design Document for the Project for which NTP has been issued	ZD + 60
4)	Handing over of complete site by MAHAPREIT for site mobilization by the contractor.	ZD + 120
5)	Commencement of Site development Work	ZD + 125
6)	Commencement of Civil Work	ZD + 130
7)	Detailed engineering and approvals	ZD + 140
8)	Completion of supply of major balance of Items (MMS, Power Conditioning Units, Transformers, cables etc.)	ZD + 180
9)	Completion of Civil Work & Erection of MMS as per agreed schedule	ZD + 210
10)	Completion of Civil Work for Inverter Room, Control room, Switchyard & general civil work as per agreed schedule	ZD + 230
11)	<b>Completion of supply of Solar PV Modules as per agreed schedule.</b>	ZD + 280
12)	<b>Completion of Erection &amp; Interconnection of Modules as per agreed schedule</b>	ZD + 290
13)	Installation and interconnection of all DC & AC circuit	ZD + 310
14)	Interconnection of entire Plant & Testing	ZD + 350
15)	<b>Commissioning of Entire Plant in line with the procedure elaborated in Standard PPA document</b>	ZD + 360
16)	Operational Acceptance Test	ZD + 365
17)	Final Acceptance	ZD + 380

Note:

- i. The contractor shall submit activity wise Project Master Schedule (PMS) i.e., L1 schedule including all the activities mentioned above along with the bid and Project co-ordination schedule (PCS) i.e., L2 schedule within 21 days after the date of issue



*of Letter of Award by the Employer as per Clause No 3.21.3.*

- ii. In case bidder fails to supply the solar PV modules within the prescribed timeline stipulated at sr. no 11 above, MAHAPREIT shall reserve the right to procure the full/partial quantity (as the case may be) of solar PV modules at the risk and cost of the contractor.*
- iii. In case of delay in performance of activity at sr. no 4 above by employer, total period of such delay shall be counted for extension in time period for other activities*

3.17.3. The contractor shall provide the detailed program of supply in details and delivery schedule along with work schedule thereto. Strict adherence and guaranteed delivery schedule mentioned in terms and conditions shall be the essence of the contract and delivery schedule must be maintained. Any deviation from the submitted schedule must be mutually discussed by the Parties and shall be at discretion of MAHAPREIT to allow, if deem it fit.

### 3.18. PROTECTION AT WORK

3.18.1. The contractor shall have total responsibility for protecting his work till it is finally taken over by the Employer. No claim will be entertained by the employer for any damage or loss to the contractors' works and the contractor shall be responsible for the complete restoration of the damaged work to its original condition to comply with the specifications and drawings. Should any such damage to the contractor's work occur because of other party not under his supervision or control, the contractor shall make his claim directly with the party concerned. If disagreement or conflict or dispute develops between the contractor and the other party or parties concerned regarding the responsibility for damage to the contractor's works, the same shall be resolved amicably by the Contractor with other party. The contractor shall not cause any delay in the repair of such damaged work because of any delay in the resolution of such disputes. The contractor shall proceed to repair the work immediately and no cause thereof will be assigned pending resolution of such dispute.

### 3.19. PROTECTION OF PROPERTY AND CONTRACTOR'S LIABILITY

3.19.1. The contractor shall be responsible for any damage resulting from his operations. The Contractor shall also be responsible for protection of all persons including members of public and employees of the Employer and the employees of other contractors and sub- contractors and all public and private property including structures, building, other plants and equipment and utilities either above or below the ground.

3.19.2. The contractor will ensure provision of necessary safety equipment such as barriers, sign-boards, warning lights and alarms, etc. to provide adequate protection to persons and property inside the plant premises. The contractor shall be responsible to give reasonable notice to the Employer and the employers of public or private property and utilities when such property and



utilities are likely to get damaged or injured during the performance of his work and shall make all necessary arrangements with such Employers, related to removal and/or replacement or protection of such property and utilities.

### 3.20. WORK EXECUTION

- 3.20.1. All the work shall be executed in strict conformity with the provisions of the contract documents, explanatory detailed drawings, specifications and instructions by the Engineer-in-Charge whether mentioned in the contract or not. The contractor shall be responsible for ensuring that works are executed in the most substantial, proper and workman like manner using the quality materials and labour, throughout the job Completion in strict accordance with the specifications and to the entire satisfaction of the Engineer-in-Charge. The Contractor shall, at all times during execution of the Contract, carry out the work with such labour force and equipment as are sufficient to complete it within the specified completion period. Engineer-in-Charge reserves the right to direct the Contractor to supplement the construction plant capacity, change sequence and method of operation and/or increase the manpower employed to execute the contract, if it is felt that the same is not sufficient achieving the completion target of the work as per schedule, without any extra cost to the Employer.
- 3.20.2. **Representative of Employer:** - Within seven (07) days of the signing of Contract Agreement, the Employer shall appoint and notify the Contractor in writing of the name of the Engineer-in-Charge (herein after referred as EIC). The Employer may from time to time appoint some other person as the Engineer-in-Charge in place of the person previously so appointed, and shall give a notice of the name of such other person to the Contractor without delay. The Engineer-in-Charge shall represent and act for the Employer at all times during the currency of the Contract. All notices, instructions, orders, certificates, approvals and all other communications under the Contract shall be given by the Engineer-in-Charge, except as herein otherwise provided in the contract.
- 3.20.3. Representative of Contractor: -**
- a) Within seven (07) days of issue of LOA by the Employer, the Contractor shall appoint a senior level executive as the "Project Manager" for Project Planning, execution and management who shall be the single point of contact for all issues related to design & engineering, dispatch, civil, architectural and structural works, erection, testing commissioning and Performance Guarantee Test of the equipment. The appointed Project Manager should have experience in independently handling at least one similar project.
  - b) From the commencement of installation of the Facilities at the Site until completion of facilities, the Contractor shall appoint a suitable person 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 the



execution of the Project for proper Performance of the Contract. Whenever the Construction Manager is absent from the Site, a suitable person shall be appointed by the contractor to act as his or her deputy.

- c) During the execution of the contract, such persons appointed by the Contractor shall report to the Engineer-in-Charge or his authorized representative, for smooth execution and timely completion of the work.

#### **3.20.4.CONSTRUCTION POWER & WATER SUPPLY**

- i. The Contractor has to arrange Construction Power and water at the site for construction & operation purpose at its own cost.
- ii. Cost of electricity required during construction shall be payable by the Contractor. For construction, temporary connection for construction power from DISCOM shall be arranged by the Contractor as per applicable tariff.

#### **3.20.5.CONTRACTOR'S OFFICE AT SITE**

- a) The Contractor shall also provide and maintain an office at the site for the Contractor's staff and the Employer's Officials. Such office shall be open at all reasonable hours to receive instructions, notices or other communications. The contractor shall also provide office space for Employer's officials properly equipped with basic facilities such as office furniture, with requisite number of ACs of adequate capacity (min 1.5 Ton capacity), washroom, drinking water dispenser, at least two computers along with the computer tables, highspeed internet connectivity and other necessary amenities which shall be finalized in consultation of the Employer after award of the contract. The officeshould have at least one (1) room with minimum 2 tables, 5-6 revolving chairswith wheels and with provision for adjustment of height (hydraulically/gas lift) and proper sanitary arrangement. The contractor shall construct the siteoffice within two (02) months from the date of issue of LOA otherwise the Employer reserves the right to withhold any amount at its discretion from due payment to Contractor.
- b) The Contractor shall deploy sufficient number of qualified engineers and staff to carry out the work and they shall be available at work sites during execution of the project. The Contractor shall provide and deploy onlyqualified engineers, staff and technical personnel who are skilled and experienced in their respective area of specialization and supervisory staff who are competent to adequately supervise the work at hand. The Contractorshall supply to the Employer a chart showing the proposed organization to be established by the Contractor for carrying out work on the Facilities before signing of contract agreement. The chart shall include the identities of the key personnel to be deployed for execution of works. The Contractor shall promptly inform the Employer inwriting of any revision or alteration of such





an organization chart. The contractor shall ensure the deployment of manpower as finalized above.

### 3.21. CONTRACTOR'S FIELD OPERATION

- a) The contractor shall keep the EIC informed in advance regarding his field activity plans and schedules for carrying out each part of the work. Any review of such plan or schedule or method of work by the EIC shall not relieve the contractor of any of his responsibilities towards the field activities. Such reviews shall also not be considered as an assumption of any risk or liability by the EIC or the Employer or any of his representatives and no claim of the contractor will be entertained because of the failure or inefficiency of any such plan or schedule or method of work reviewed. The contractor shall be solely responsible for the safety, adequacy and efficiency of plant and equipment and his erection methods.
- b) The contractor shall have the complete responsibility for the conditions of the work site including the safety of all persons employed by him or his Sub-contractor(s) and all the properties under his custody during the performance of the Contract. The liability shall continue till the completion of the contract and shall not be limited to normal working hours

#### 3.21.1. Working Hours

The contractor shall ensure working hours at site as per the applicable statutory regulation(s)/government guidelines in the state where the project is located. Shift working at 2 or 3 shifts per day may also become necessary to complete the work on time and during operation of the plant and the bidders should take this aspect into consideration for formulating his rates for Price Bid. No extra claims will be entertained by the Employer on this account. The contract shall provide display boards showing progress and labour strength at work site, as directed by the Engineer-in-Charge.

#### 3.21.2. Discipline of Workmen

The contractor shall adhere to the disciplinary procedure set out by the EIC in respect of his employees and workmen at site. The EIC shall be at liberty to object to the presence of any representative or employees of the contractor at the site, if in the opinion of the EIC, such employee has misconducted himself or be incompetent or negligent or otherwise undesirable, in such situation the contractor shall debar such person objected to and substitute him by another employee.

#### 3.21.3. Program of Performance

- a) The bidders shall be required to submit activity wise Project Master Schedule (PMS) (i.e., L1 schedule) considering the completion period as specified in Clause No 3.17 of Section-III: Conditions of Contract & any other dates and periods specified in this Bid document along with the bid. The above Project Master Schedule (PMS) (i.e., L1 schedule) and the key milestone dates will be discussed

- and finalized with the successful bidder, if required before the issue of Letter of Award.
- b) Within twenty one (21) days after the date of issue of Letter of Award by the Employer, the contractor shall prepare and submit Project Co-ordination Schedule (PCS) (i.e. L2 Schedule), made in the form of PERT Network (based on Critical Path Methodology (CPM)) and showing the sequence in which it proposes to design, manufacture, procurement/supply, transport, assemble, install and commission as well as starting date and completion date of different components/activity, each milestone achievement dates pertaining to project further exploded based on the Project Master Schedule (PMS) mutually agreed by the Employer and Contractor and make the presentation to EIC of their proposed PCS and organizational resources, equipment, machineries, manpower to be deployed for timely completion of the project. This Project Co-ordination Schedule (PCS) shall form part of the contract.
  - c) PCS shall also define month-wise schedule of project components/milestones. The Contractor shall update and revise the program as and when appropriate or when required by the Employer, but without modification in the Times for Completion given in the contract and any extension granted in accordance with provisions of contract and shall submit all such revisions to the EIC.
  - d) Monthly Progress Review Meeting (MPRM) to be held on 26<sup>th</sup> of every month or in case 26<sup>th</sup> day being holiday, on the next working day. The month wise activity schedule shall be reviewed and detailed working schedule (week wise) for the next month shall be drawn up by the contractor jointly with the Engineer-in-Charge or his authorized representative in the MPRM).
  - e) Weekly Progress Review Meeting (WPRM) shall be held by EIC or its authorized representative, wherever possible at the works, wherein week wise schedule as finalized in MPRM shall be reviewed. In case of any lapses in the target, it shall be updated in Weekly Progress Review Meeting (WRPM).
  - f) The contractor shall be mandatorily required to attend the WPRM & MPRM. Minutes of WPRM/MPRM shall be recorded in triplicate and shall inter alia includethe Weekly/Monthly Program as updated, progress of work vis-à-vis agreed schedule, inputs to be provided by Employer, delays, if any and recovery program,specific hindrances to work and work instructions by Employer. These Minutes ofMeeting (MoM) shall be jointly signed by the EIC or his authorized representativeand the Contractor and one copy of the signed MoM shall be handed over to the Contractor.
  - g) The contractor shall scrupulously adhere to these targets/ Schedules by deploying adequate personnel, construction tools and tackles, materials of his scope of supply in good time to achieve the targets/ schedules.
  - h) In all matters concerning the extents of targets set out in above schedules and the degree of achievement, the decision of the Engineer-in-Charge will be final



and binding on the contractor

#### 3.21.4. Emergency Work

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

### 3.22. RIGHT OF WAY AND FACILITIES

3.22.1. SPIA will be responsible for ROW during construction and O&M for access to the 'Project Site'. However, minor work related with creation of proper access to the 'Project' shall be done by the EPC contractor.

### 3.23. SITE HINDRANCE REGISTER

3.23.1. The Contractor shall maintain a register at the site office and record hindrance, if any, in the site register to be duly signed by Contractor or his authorized representative and verified by EIC or his authorized representative.

### 3.24. WORK AND SAFETY REGULATIONS

3.24.1. The contractor shall ensure proper safety of all the workmen, materials, plant and equipment belonging to him or to the Employer or to others, working at or near the site. The contractor shall also be responsible for provisions of all safety notices and safety equipment required both by the relevant legislations and the EIC as he may deem necessary.

3.24.2. All equipment used in construction and erection by contractor shall meet Indian/ International Standards and where such standards do not exist, the contractor shall ensure these to be absolutely safe. All equipment shall be strictly operated and maintained by the contractor in accordance with manufacturer's operation manual and safety instructions and as per Guidelines/Rules of MAHAPREIT Ltd. in this regard.

3.24.3. The contractor shall provide suitable safety equipment of prescribed standard to all employee and workmen according to the need or as may be directed by EIC who will also have right to examine this safety equipment to determine their suitability, reliability, acceptability and adaptability.

3.24.4. The contractor shall provide safe working conditions to all workmen and employees at the site including safe means of access, railings, stairs, ladders, scaffoldings etc. The Scaffoldings shall be erected under the control and supervisions of an experienced and competent person. For erection, good and standard quality of material only shall be used by the contractor.

3.24.5. The EIC shall have the right at his sole discretion to stop the work, if in his opinion the work is being done in such a way that it may cause accidents and endanger the safety of the persons and/or property, and/or equipment. In such cases, the contractor shall be informed in writing about the nature of hazards



and possible injury/accident and he shall comply to remove short comings immediately.

- 3.24.6. The contractor shall not be entitled for any damages/compensation for stoppage of work due to safety reasons as provided in Clause No. 3.24.5 above and the period of such stoppage of work will not be taken as an extension of time for completion of work and will not be the ground for waiver of levy of liquidated damages.
- 3.24.7. The contractor shall follow and comply with all MAHAPREIT. Safety Rules and relevant provisions of applicable laws pertaining to the safety of workmen, employees, plant and equipment as may be prescribed from time to time without any demur, protest or content or reservation. In case of any inconformity between statutory requirement and MAHAPREIT Safety Rules, if any, referred above, the statutory requirement/provisions shall be binding on the contractor. MAHAPREIT shall provide safety manual to the successful Bidder.

### 3.25. ACCESS TO SITE AND WORKS ON SITE

No persons other than the Employer's representative, the contractor or his duly appointed representative, Sub-contractor(s) and workmen, shall be allowed to do work on the site, except by the special permission, in writing of the EIC or his representative.

### 3.26. PROGRESS REPORT

- 3.26.1. The Contractor shall monitor progress of all the activities specified in the work schedule/Timelines referred in Clause No 3.17, and submit the progress report to the Engineer- in Charge. The progress report shall be in a form acceptable to the Engineer- In Charge and shall include percentage completion achieved compared with the planned percentage completion for each activity, where any activity is behind the program, giving comments and likely consequences and stating the corrective action being taken and any such other information as required by the EIC.
- 3.26.2. The Contractor shall furnish, along with the progress report, photographs indicating various stages of civil, architectural, erection, testing and commissioning activities, each Photograph shall contain the date, the name of the Contractor and the title of the view taken
- 3.26.3. If at any time the Contractor's actual progress falls behind the schedule referring to in Clause No 3.17.2 (Timelines ), or it becomes apparent that it will so fall behind, the Contractor shall, prepare and submit to the Engineer- In Charge a revised program, taking into account the prevailing circumstances, and shall notify the Engineer- In Charge of the steps being taken to expedite progress so as to attain Completion of the Facilities within the Time for Completion as mentioned under Clause No 3.17 (Timelines), any extension thereof entitled



under Clause 3.61 (Time Extension), or any extended period as may otherwise be agreed upon between the Employer and the Contractor.

### 3.27. SPECIFICATIONS AND DRAWINGS

- 3.27.1. 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. The Contractor shall be responsible and shall pay for any alterations of the work 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/reviewed by the Engineer-in-Charge or not.
- 3.27.2. The materials, design and workmanship shall satisfy the applicable standards, specifications contained herein and codes referred to. Where the Contract Document stipulates requirements in addition to those contained in the standard codes and specifications, those additional requirements shall also be satisfied.
- 3.27.3. Three (03) prints of all relevant drawings along with soft copies of drawings in pdf in DVD/CD/USB drive as defined in the technical specifications, shall be submitted by the contractor. No extension in Contract completion time shall be allowed on account of the time consumed in submission and examination of defective drawings and re- submission of corrected drawings.
- 3.27.4. In addition to the drawings defined in the technical specification, the Contractor will furnish any other drawing, which, in his opinion, is necessarily required to describe the equipment in full details and interconnection thereof and any drawings which EIC may request.
- 3.27.5. These drawings, shall become the property of the Employer and shall not be departed from it in anyway, whatsoever, except with the written permission of the Engineer-in-Charge hereinafter provided.
- 3.27.6. The Contractor shall also furnish Five (05) bound sets of "as built" drawings and the list of all "as built" drawings bearing drawing numbers after commissioning, incorporating all site modifications/changes etc.
- 3.27.7. The Employer/EIC shall have the right to serve notice in writing to the Contractor on any grounds of objections, which he may have in respect of any drawings, equipment and workmanship which is in his opinion not in accordance with the contract. The Contractor shall give due consideration to such objections and shall either make modifications that may be necessary to meet the said objections or shall inform in writing to the EIC giving reasons therein, that no modifications are necessary to comply with the contract. The Contractor has to satisfy the objection, otherwise, The Employer/EIC at its liberty may reject all or any component of plant or workmanship connected with such work.

### 3.28. APPROVAL / REVIEW OF DRAWINGS & DOCUMENTS

3.28.1. The Contractor shall prepare and furnish to the EIC the documents as per Contract Agreement for its approval or review. EIC shall review the documents furnished by the contractor and give the feedback or approval within 07 days from the date of submission of documents by the contractor. Any part of the Facilities covered by or related to the documents to be approved by the EIC shall be executed only after the EIC's approval thereof. Document furnished by the Contractor, shall not relieve the Contractor of any responsibility or liability imposed upon it by any provisions of the Contract.

### 3.29. PACKING, FORWARDING

3.29.1. The Contractor shall be responsible for securely protecting and packing the plant and equipment, taking special care for protruding parts and such other vulnerable parts as per prescribed standards enforced to withstand the journey and ensuring the safety of materials and also arrival of materials at destination in good and original condition for contemplated use, so as to avoid damage under normal conditions of transport, loading & unloading, handling and storage at site till the time of erection and such conditions as specified in the Contract. The Contractor shall be responsible for any loss or damage during transportation, handling and storage due to improper packing. Each bundle or package shall have the following marking on it:

- i. The name and address of the consignee.
- ii. The relevant marks, reference numbers etc., for identification.
- iii. Directions for handling the materials

Each package shall also be accompanied with detailed packing list to facilitate checking of the contents at the destination

3.29.2. The Contractor shall also give all dispatch information concerning the weight, size and content of each package, including any other information which the Employer may require.

3.29.3. The Proof of dispatch three copies shall be mailed to the Engineer-in-Charge within three (03) days from the date of dispatch to enable the Employer to make progressive payment to the Contractor.

3.29.4. In case of imported equipment, the Contractor shall make shipping arrangements as per Government of India Guidelines. The Contractor shall, wherever applicable, pack all equipment, crate, preserve, make it seaworthy and fit for long storage in tropical climate in accordance with internationally accepted export practices and in such manner so as to protect it from damage and deterioration in transit by sea, rail and road, and during storage at the site till the time of erection. The Contractor shall be responsible for all damage due



to improper packing. Customs clearance shall be the responsibility of the Contractor. The Contractor shall notify the Employer of the date of each shipment from the port of such shipment at the designated point of arrival. The Contractor shall give complete shipping information concerning the weight, size, content of each package including any information the Employer may require.

- 3.29.5. All demurrage, wharfage and other expenses incurred due to delayed clearance of the material and which are attributable to the Contractor and Sub-Contractor during transportation shall be to the account of the Contractor.

### 3.30. TRANSPORTATION

- 3.30.1. The Contractor shall at its own risk and expense transport all the Plant and Equipment and the Contractor's Equipment to the Site by the mode of transport that the Contractor judges most suitable under all the circumstances.
- 3.30.2. The Contractor shall notify the Employer/EIC the details of dispatch for every month from his works and the expected date of arrival at the site for the information of the Employer. The Contractor shall furnish the Employer/EIC with relevant shipping documents to be agreed upon between the parties.
- 3.30.3. The Contractor shall prepare detailed challan / packing list of all packages dispatched to site. The Contractor shall further be responsible for making all necessary arrangement for loading, unloading and other handling right from his work to and at the site.
- 3.30.4. In case the contractor decides to transport the goods by road within the Employer country, then such goods necessarily be transported through a registered common carrier as per "The Carriage by Road Rules 2011".

### 3.31. DELIVERY OF PLANT EQUIPMENT

- 3.31.1. The Contractor shall deliver the plant / equipment / materials at the place(s) and in the manner as specified in the Contract. The Contractor shall comply with all instructions that may be given by the Employer from time to time regarding transportation of the plant/equipment/materials. The contractor shall, immediately after dispatch, provide delivery information to the Employer.
- 3.31.2. In case of any damage or loss occurred in transit, it shall be the liability of the Contractor to initiate or pursue the claim with the Insurance Company. He shall also take immediate steps to repair the damages or to replace the loss and damages as per the instruction of the Engineer-in-charge.
- 3.31.3. Property or title of the plant / equipment / goods shall not pass to the Employer unless these are actually delivered at the designated Project without any damage.
- 3.31.4. The Employer shall not be responsible to the Contractor to secure/arrange/provide means of transport. Similarly, any road license and or permit, if necessary, shall be arranged by the Contractor. However, if any



documentary assistance is necessary to facilitate transportation, these will be supplied to the Contractor to the extent possible.

- 3.31.5. No material shall be dispatched from the manufacturer's works before the same is accepted, subsequent to pre-dispatch final inspection including verification of records of all previous tests/inspections by the EIC/Authorized representative of Employer and duly authorized for dispatch by issuance of Material Dispatch Clearance Certificate (MDCC).

### 3.32. MATERIALS HANDLING AND STORAGE

3.32.1. All the equipment supplied under the contract and arriving at site shall be promptly received against indemnity bond, unloaded, transported and stored in the designated storage facilities arranged/constructed by the contractor. All the equipment shall be stored as per standard storage and preservation instructions etc. of the suppliers/manufacturers. The equipment stored shall be properly protected to prevent damage either to the equipment or to the floor where they are stored and also from theft, pilferages etc. The storage facilities shall also include enclosed storage space(s) of suitable size(s) and shall be weatherproof, with good ventilation and solid floors.

3.32.2. The following parts shall be stored inside enclosed storage space(s):

- i. Bolts, pins, packing, tools, insulation materials, electrical parts with electrical devices attached, electric motors and PCU inverters, instruments, welding material and equipment, all small parts and all parts of the plant which already have been finally painted.
- ii. If large parts are stored in the open air, they shall be provided with weather resistant and fire-resistant covers. Electrical parts, which are not packed suitably and those so packed, but whose packing has been damaged shall be kept in suitable places from the moment of storage to the moment of installation.

3.32.3. Contractor shall be responsible for examining all the dispatches and notify the EIC immediately of any damage, shortage, discrepancy, etc. for the purpose of EIC's information only. The contractor shall also submit to the EIC every week a report detailing receipt of material at site, material issued for installation/erection, balance material at store. However, the contractor shall be solely responsible for any shortage or damage in transit, handling and/or in storage and erection of the equipment at the site. Any demurrage, wharfage and other such charges claimed by the transporters shall be to the account of the contractor.

3.32.4. All equipment shall be handled very carefully and shall be moved to the actual location at the appropriate time so as to avoid damage of such equipment at site.

### 3.32.5. INDEMNITY BOND





The contractor shall sign and submit Indemnity Bond(s) in the format as attached at Annexure 5 of the Bid Document and shall be obliged and shall remain absolutely responsible for the safe transit protection and custody of the Equipment of MAHAPREIT against all Contractor's risks whatsoever till the Equipment are duly used/erected and commissioned in accordance with the terms of the Contract till the same is taken over by EIC. Subsequent to commencement of Operation and Maintenance of the Plant, the contractor shall again sign and submit Indemnity Bond in the format as attached at Annexure-6 of the Bid Document.

- 3.32.6. The Contractor shall keep Employer harmless against any loss or damage that may be caused to the Equipment. The Contractor shall ensure that the Equipment shall be used exclusively for the performance /execution of the Contracts strictly in accordance with its terms and conditions and no part of the equipment shall be utilized for any other work or purpose whatsoever. The non-observance of the obligations under the Indemnity Bond by the Contractor shall inter- alia constitute a criminal breach of trust on the part of the Contractor for all intents and purposes including legal/penal consequences.

### 3.33. MATERIALS AND WORKMANSHIP

- 3.33.1. The Contractor shall also guarantee that the plant, equipment and materials shall be new and of best quality workmanship and the materials shall have no defect in design and/or manufacture, and shall meet the requirements of the specification and shall be in all respects suited for purposes intended.
- 3.33.2. The Contractor shall guarantee, inter-alia, the following: -
- a) Use of best quality and strength of materials
  - b) Satisfactory Performance during the period of operation
  - c) Achievement of Performance figures as specified for all parts under the severest condition of operation
- 3.33.3. 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.
- 3.33.4. The Contractor shall remedy, without any cost to the Employer, all defects in design materials and workmanship which may develop under normal use and which have been called to the attention of the Contractor prior to the expiry of the warranty period.

### 3.34. NO WAIVER OF RIGHTS

- 3.34.1. Subject to Clause No 3.34.2 below, no relaxation, forbearance, delay or indulgence by either party in enforcing any of the terms and conditions of the Contract or the granting of time by either party to the other shall prejudice, affect or restrict the rights of that party under the Contract, nor shall any waiver



by either party of any breach of Contract operate as waiver of any subsequent or continuing breach of Contract.

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

### 3.35. INSPECTION AND TESTING

- 3.35.1. The Engineer-in-charge or his duly authorized representative and/or an external inspection agency acting on behalf of the Employer shall have access, at all reasonable time to inspect and examine the materials and workmanship of the plant / equipment during its manufacture, erection, shop assembly and testing and if part of the plant is being manufactured or assembled on another premises or works, the Contractor shall obtain for the Engineer-in-charge and his duly authorized representatives, permission to inspect it as if the works were manufactured or assembled on Contractor's own premises or works.
- 3.35.2. The Contractor shall give the written notice to Employer, for testing of any material being ready for inspection/testing at least 15 (Fifteen) days in advance from the date of actual inspection/testing at the premises of the Contractor or elsewhere. Such Inspection / testing shall be carried out to the Contractor's account except for the expenses of the representative of the Employer. However, the Employer at its own discretion may waive the inspection / testing in writing under very special circumstance. The Engineer-in- Charge or his representative (s), unless the inspection of the tests is in writing waived, shall attend such tests on the date of which the equipment is notified by the Contractor as being ready for test / inspection, failing which the Contractor may proceed with the tests which shall be deemed to have been made in the Employer's presence. The Contractor shall forthwith forward to the Engineer-in-charge duly certified copies of test results in quadruplicate, for approval of the Engineer-in-charge. However, waiver accorded by the EIC will not absolve the Contractor towards the execution of the Contract in conformity with the Contract Agreement
- 3.35.3. The Engineer-in-Charge shall, within 15 (Fifteen) days from the date of inspection as defined herein, give notice in writing to the Contractor, of any objection to any drawing, testing procedure and testing facility and all / or any equipment and workmanship which in his opinion is not in accordance with the Contract. The Contractor shall give due consideration to such objection and shall make the modifications that may be necessary to meet the said objection at no extra cost to the Employer.
- 3.35.4. When the factory tests have been completed at the Contractor's or Sub-Contractor's works, the Engineer-in-Charge shall issue a certificate to this effect



within 15 (Fifteen) days after completion of tests. However, if the tests are not witnessed by the Engineer- in-Charge, the certificate shall be issued within 15 (Fifteen) days of receipt of the Contractor's test certificate by the Engineer- in-Charge only when the tests have been carried out as per relevant codes / standards. The completion of these tests or the issue of the certificate, shall not bind the Employer to accept the equipment, should it, on further tests after erection, be found not to comply with the Contract

- 3.35.5. In all cases where the Contract provides for inspection/ tests to be carried out, whether at the premises of the Contractor or of any Sub-Contractor, the Contractor/Sub- Contractor shall provide free of charges such items as labour, materials, electricity, fuel, water, stores, apparatus, instruments etc. as may reasonably be demanded by the Engineer-in-Charge or his authorized representative(s) to carry out efficiently such test / inspection of the plant / equipment in accordance with the Contract and shall give facilities to the EIC or to his authorized representative to accomplish testing. Charges for any special test(s), other than those specified in the Contract, if required, will be paid by the Employer. Rate(s) for such special test(s) shall be mutually discussed and agreed.
- 3.35.6. All inspection, measuring and test equipment used by contractor shall be calibrated periodically depending on its use and criticality of the test/measurement to be done. The Contractor shall maintain all the relevant records of periodic calibration and instrument identification, and shall produce the same for inspection by MAHAPREIT. Wherever asked specifically, the Contractor shall re- calibrate the measuring/test equipment in the presence of EIC.
- 3.35.7. The Employer or his authorized representative shall have the right to carry out inward inspection of the items on delivery at Site and if the items have been found to be not in line with the approved specifications, shall have the liberty to reject the same.
- 3.35.8. The Contractor has to provide the necessary testing reports to the Employer as and when required.
- 3.35.9. The Contractor shall submit 3 (three) copies of purchase order for materials purchased / to be purchased for use in the works, which will require inspection / testing by the Employer's representative at the places other than the Contractor's works before shipment. In such cases, all the above-mentioned clauses will apply. When the inspection/test has been satisfactorily completed, the Employer will issue a certificate to that effect.
- 3.35.10. Neither the waiver of inspection / testing nor acceptance after inspection and or testing by the Employer shall relieve the Contractor in way of the responsibility of supplying the plant/equipment/materials strictly in accordance



with the specifications, drawings, etc. In any case, the Contractor shall remain fully responsible for satisfactory performance of the plant/equipment/materials.

### 3.36. THIRD PARTY INSPECTION AGENCY

3.36.1. A third-party inspection agency ("Third Party Inspectors" or "TPI") may be appointed by the Employer, at its sole discretion, to conduct any kind of inspection regarding procurement, fabrication, installation, hook-up and commissioning during the execution of the Project. The Contractor shall provide necessary access and coordination to conduct such inspections. The extent of third-party inspectors' involvement shall be finalized after mutual discussions between the Contractor and the Employer.

### 3.37. AUTHORIZED TEST CENTRES FOR TEST CERTIFICATES

3.37.1. The solar PV Modules to be supplied under the contract shall be sourced only from the Model and Manufactures included in the latest "Approved List of Models and Manufactures (ALMM)" issued by MNRE.

3.37.2. The 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 the equipment for which such Test facilities may not exist in India, test certificates from reputed ILAC Member body accredited Labs abroad (with proper proof of accreditation) will be acceptable.

### 3.38. COMMISSIONING

3.38.1. As soon as installation of the Facilities, in the opinion of the Contractor, has 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 Engineer-in-Charge in writing to witness the pre-commissioning of the Facility.

3.38.2. After all the 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 Engineer-in-charge in writing. The commissioning of the facilities shall be carried out in the presence of the Engineer-in-charge or his representative(s) in accordance with the procedure specified in Technical specification.

3.38.3. After commissioning of the entire plant, the Commercial Operation Date (COD) shall be declared by the concerned authority.

3.38.4. The period of O&M shall commence immediately after the COD of the entire Plant.

### 3.39. PART COMMISSIONING

Part commissioning of the Project shall be allowed in two parts as mentioned below:



- Minimum project capacity to be commissioned in the first part shall be 50% of which NTP has been issued.
- Balance capacity in the second part

#### 3.40. OPERATIONAL ACCEPTANCE

- 3.40.1. Operational Acceptance shall occur in respect of the Facilities (or any part of the Facilities where the Contract provides for acceptance of the Facilities in parts) when the Performance Guarantee Test, as specified and in accordance with the procedure(s) specified in Section-IV: Technical Specifications, have been successfully completed.
- 3.40.2. At any time after successful completion of Guarantee Test(s) for Operational Acceptance, the Contractor shall give a notice of seven (07) days to the Employer requesting the issue of Operational Acceptance Certificate in respect of the Facilities or the part thereof specified in such notice. The Employer shall issue an Operational Acceptance Certificate upon the receipt of such notice provided Commissioning Certificate has been issued by the State Nodal Agency or Implementing Agency and COD of the entire plant or part thereof has been declared.
- 3.40.3. In case of any shortfall in the Performance Guarantee, the contractor shall make all necessary corrections in minimum possible time and shall repeat the Plant Performance Guarantee Test (PG Test) and any other Guarantee Tests as specified in the specifications in accordance with the procedure specified in the specifications within thirty (30) days of unsuccessful PG attempt, so as to demonstrate the PG as specified in Technical Specification.

#### 3.41. FINAL ACCEPTANCE AND WORK COMPLETION CERTIFICATE

##### 3.41.1. Final acceptance shall occur when:

- a) Contractor has completed the supply installation, testing & commissioning of all the components of the Plant & Equipment along with its associated infrastructure & facilities in all respect, successfully completed all outstanding works and completion of all facilities in accordance with scope of works as specified in Technical Specifications as per satisfaction of Engineer-in-Charge and has submitted all technical documentation and acceptance of the same by Engineer-in-Charge.
- b) The Employer/EIC has issued Operational Acceptance Certificate for the entire capacity of the project.
- c) The Contractor has submitted the requisite Contract Performance Cum Security Guarantee (CPSG) as per Clause No. 3.48.
- d) The Contractor has paid the Liquidated Damages as per the Clause No. 3.49 (if applicable)



3.41.2. Work Completion Certificate will be issued by Employer /EIC on occurrence of Final Acceptance.

### 3.42. REJECTION OF DEFECTIVE PLANT

3.42.1. If, during the progress of works, the Engineer-in-Charge shall decide and inform in writing to the Contractor that the Contractor has assembled any plant or part of the plant unsound or imperfect or has furnished any plant inferior to the quality specified, the Contractor, on receiving details of such defects or deficiencies shall, at his own expense, within 7 ( Seven) days of receiving notice or otherwise, and for a period of time as may be decided by the Engineer-in-Charge for making it good, proceed to alter, reconstruct or remove such work and furnish fresh equipment up to the standard of specifications. In case the Contractor fails to do so, the Engineer-in-charge may, on giving the Contractor minimum 7 (Seven) days' notice in writing of his intentions to do so, proceed to remove the portion of the work so complained of and at the risk and cost of the Contractor, perform all such work or furnish all such equipment, provided that nothing in this Clause shall be deemed to deprive the Employer of or affect any rights under the Contract which the Employer may otherwise have in respect of such defects and deficiencies.

3.42.2. In case of such replacement / rectification by the Employer, the Contractor shall be liable to pay to the Employer the extra cost, if any, for such replacement/by delivery and/or erected, as provided for in the original Contract, such extra cost being the ascertained difference between the price by the Employer under the provision above mentioned, for such replacement and the Contract price for the plant so replaced. If the Employer/EIC does not so replace the rejected plant, the Contractor shall be liable only to repay to the Employer/EIC all money paid by the Employer to him in respect of such plant.

3.42.3. In the event of such rejection, the Employer shall be entitled to the use of the plant in responsible and proper manner till a time reasonably sufficient to enable him to obtain other replacement plant.

### 3.43. GUARANTEE AND WARRANTY

3.43.1. The Contractor must ensure that the goods supplied under the contract are new, unused and of specified models and incorporate all recent improvements in design and materials unless provided otherwise in the contract. The warranty / guarantee period shall be as follows:

- a) Solar PV Modules: The warranties for Solar PV Modules shall be as specified in Section- IV: Technical Specification. Material/product Warranty shall be at least 10 years and Performance / power output warranty of Solar Module(s) shall be for at least 90% of its rated power at the end of 10 years

and 80% of its rated power at the end of 25 years from the date of receipt of modules on Site. The manufacturer shall warrant for the linear output of Solar Module(s) and degradation of the PV modules will be linear over 25 years from the date of receipt of modules at site.

- b) Power Conditioning Units (PCU)/ Inverters: PCUs shall be warranted for the minimum period of 7 years or guarantee period provided by the OEM whichever is higher.
- c) The mechanical structures, electrical works and overall workmanship of the power plant must be warranted as specified in clause 3.44 (Defect Liability).
- d) Transformers, associated switch gear and others: The Contractor shall furnish warranties / guarantees in respect of the items presented by the supplier/OEM.

- 3.43.2. Manufacture shall furnish in details their warranties / guarantees for these items. Transformers, CT, PT & switch gears, DC Cables, HT cables, SCB & SMS, SCADA, CCTV System shall be warranted for minimum period of 7 Years.
- 3.43.3. Manufacturer's Warranty/Guarantee certificate shall be furnished by the contractor as per Clause No. 3.43.1.
- 3.43.4. Before finalizing the purchase order all warranty/guarantees agreements of equipments & material shall be approved from MAHAPREIT. During the period of Warranty / Guarantee the Contractor shall remain liable to replace any defective parts, that becomes defective in the plant, of his own manufacture or that of his sub-Contractors under the conditions provided for by the contract under and arising solely from faulty design, materials or workmanship, 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
- 3.43.5. In respect of goods not covered by the Sub Clause 3.43.1, the Employer shall be entitled to the benefit of such guarantee given to the Contractor by the original Contractor or manufacturer of such goods.
- 3.43.6. 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.
- 3.43.7. Any defects in the work during the guarantee period shall therefore, be rectified by the Contractor without any extra cost to the Employer within a reasonable time as may be considered from the date of defect notice failing which the Employer reserves the right to take up rectification work at the risk and cost of the Contractor.
- 3.43.8. In the event of emergency where, in the judgment of the Engineer-in-charge, delay would cause serious loss or damage, repairs, replacement, rectification, adjustment etc. may be done by the Engineer-in-charge or by any other Agency chosen by the Engineer-in-charge at the risk and cost of the Contractor.



However, the Contractor shall assist the Employer/other Agency employed for necessary corrections. This shall not relieve the Contractor from any of his liability under the terms of the Contract. In case of defective parts which are not repairable at site but are essential for the commercial operation of the equipment, the Contractor and the Engineer-in-charge shall mutually agree to prepare rolling program for replacement or renewal, which will minimize interruption to the maximum extent, in the operation of the equipment.

- 3.43.9. In respect of goods supplied and or works done by the Contractor or goods supplied by the Sub-Contractor(s) to the Contractor where a longer guarantee is provided by such sub- Contractors, the Employer shall be entitled to the benefit of such longer guarantee period.
- 3.43.10. In case of defective parts which are not repairable at site but are essential for the operation of the equipment, the Contractor and the Engineer-in-charge shall mutually agree to an improvised arrangement to be made by the Contractor to ensure continued plant operation and to a Programme of replacement or renewal which will minimize interruption/dislocation to the maximum extent in the operation of the equipment. The cost of transportation, including all taxes & duties etc. as applicable, Insurance of defective parts from site and replacement will be borne by the Contractor.
- 3.43.11. It shall be expressly understood that all expenses in respect of replacement/repair during the warranty period or extended warranty period or as latent defects as noted above including, but not limited to, transportation cost, all taxes, duties and levies as applicable, etc. till such spare parts are installed in the main equipment/ plant after necessary replacement/repair and the main equipment/ plant is put back into operation, shall entirely be to the Contractor's account.

#### 3.44. DEFECT LIABILITY

- 3.44.1. The contractor shall warrant that the equipment will be new & in accordance with the contract documents, relevant standards and free from defects arising due to deficiencies in design & engineering and from defects in material and workmanship for a period of 12(twelve) calendar months from the date of Operational Acceptance of the entire plant. The Contractor shall be liable to replace/ upgrade with the specific consent of MAHAPREIT, any defective parts in the equipment supplied and erected by him under the contract arising solely from faulty design, materials and /or workmanship. All replaced defective parts shall be returned to the Contractor unless otherwise arranged by MAHAPREIT.
- 3.44.2. If it becomes necessary for the contractor to replace or renew any defective component/part of the plant, the provision of this clause shall apply to such component/part of the plant so replaced or renewed and the Defect Liability Period for such replaced or renewed component/part of the plant shall be





extended for a period of 12 (twelve) calendar months from the date of such replacement/renewal or thirty- six (36) calendar months from the date of Operational Acceptance of the entire plant, whichever first occurs. The rectification / replacement / repairs shall be done at the shortest possible time to minimize the loss of the Employer and as mutually agreed to. If any defects are not remedied within a reasonable time, MAHAPREIT may proceed to do the work as per Clause No. 3.64, but without prejudice to any other rights, which MAHAPREIT may have against the contractor in respect of such defects.

- 3.44.3. The repaired or new parts will be furnished and erected free of cost by the Contractor. If any repair is carried out on contractor's behalf by MAHAPREIT at the site through some other Agency, the Contractor shall bear the cost of such repairs.
- 3.44.4. The cost of any special or general overhaul rendered necessary during the defect liability period due to defects in the plant or defective work carried out by the Contractor shall be borne by the Contractor.
- 3.44.5. The acceptance of the equipment by the MAHAPREIT shall in no way relieve the Contractor of his obligations under the Contract.
- 3.44.6. The Contractor shall be responsible for any loss or damage to the plant until the O&M contract is over.

### 3.45. COMPENSATIONS FOR SHORTFALL IN NET ANNUAL GUARANTEED GENERATION DURING O&M

#### 3.45.1. Criteria for Generation

For each year of O&M, the contractor shall demonstrate actual delivered energy at CTU/STU end metering point as compared to the Declared Net Annual Guaranteed Generation (kWh) as per Attachment 10 of Section V: Bid Response Sheets and Annexures for that particular year.

#### 3.45.2. Shortfall in Generation During O&M

- a) If the contractor fails to achieve declared Net Annual Guaranteed Generation (kWh) as per Attachment 10 of Section V: Bid Response Sheets and Annexures, at delivery point (accounted annually for each year of O&M), the contractor shall pay to the employer the compensation towards shortfall in declared Net Annual Guaranteed Generation along with applicable GST as detailed in Technical Specification.
  - b) The generation loss shall be relaxable to the extent of grid non-availability for evacuation which is beyond the control of the contractor and other factors not attributable to the contractor as specified in the Technical specifications.
- 3.45.3. In case the project fails to generate any power continuously for two (2) months any time during the O&M period (due to reason(s) attributable to the contractor) it shall be considered as an event of default. Upon occurrence of any such event



of default, MAHAPREIT shall have right to encash the entire amount of O&M Bank Guarantee or equivalent amount from CPSG submitted by the contractor and recover the losses from any payment due.

#### **3.45.4. Excess Generation During O&M**

In case the generation is more than 10% of the declared generation, the Employer will be free to sell it to any entity.

#### **3.46. MANUALS AND DESCRIPTIVE LITERATURE**

3.46.1. The Contractor shall furnish 3 (Three) copies of Instruction Manuals at least 1 (One) month prior to commencement of Pre-Commissioning activities. The manuals shall contain full details such as drawings of all the equipment furnished, storage procedures and operation and maintenance procedures of the equipment. Descriptive literature and data on various equipment shall also be furnished along with these manuals.

#### **3.47. SPARES**

- 3.47.1. The Contractor shall supply and maintain adequate inventory of all the spares (including software) required for safe, reliable and trouble-free operation & maintenance of the complete Solar PV Plant during the period of contract. The price of these spares shall be deemed to be included in the contract price.
- 3.47.2. The list of mandatory spares envisaged by the Employer has been mentioned at Section-IV: Technical Specifications. The Contractor may note that it shall be the responsibility of the Contractor to ensure sufficient spares including but not limited to the mandatory spare list to maintain its contractual obligations.
- 3.47.3. All spares for the equipment under the Contract will strictly conform to the specification and will be identical to the corresponding main equipment /components supplied under the Contract and shall be interchangeable.
- 3.47.4. Without any extra cost, the Contractor shall provide the Employer with the catalogues, drawings, part numbers and any other information/documents required by the Employer in the form of manual(s) so as to enable the Employer to identify the spares required during the whole life of all the equipment to be supplied.
- 3.47.5. The Contractor shall ensure the long-term availability of spares for the equipment covered under the Contract. In case, any spare becomes obsolete, the Contractor will ensure adequate inventory of other equivalent make of such obsolete spare and shall also provide to the Employer, detailed information (catalogues, make, part number, drawings etc.,) of the same.
- 3.47.6. Further in case of discontinuance of supply of spares by the Contractor or his Sub- Contractors, the Contractor will provide the Employer with full information for replacement of such spares with other equivalent make.



3.47.7. The Contractor shall provide a list of all the spares required to maintain the facility for two (02) years. The Contractor agrees to supply such spare parts, as recommended or otherwise required for efficient operation and maintenance of the Facilities.

### 3.48. CONTRACT PERFORMANCE GUARANTEE

3.48.1. Within twenty-eight (28) days from the date of issue of Letter of Award by the Employer, the Successful Bidder shall furnish to the Employer, an unconditional/irrevocable Contract Performance cum Security Guarantee (CPSG) for an amount equivalent to 3% of total value of EPC Contract Price with a validity up to sixty (60) days beyond the expiry of Defect Liability Period as per Clause No 3.44 of this Bid Document.

3.48.2. The Contractor shall submit a CPSG for an amount equivalent to 3% of Contract Price, whichever is higher, with initial validity up to next 02(Two) year, 30 days prior to expiry of earlier CPSG submitted by the contractor as per Clause No 3.48.1.

3.48.3. Every year a fresh bank guarantee shall be submitted by the Bidder, having validity for the subsequent year, one month prior to expiry of existing Bank Guarantee or the existing bank guarantee can be amended suitably for specified amount every year till 60 days beyond the O&M contract Period.

3.48.4. The Bank Guarantee against CPSG submitted by the contractor as per Clause No 3.48.1 shall be discharged by the Employer and returned to the Contractor without any interest, not later than sixty (60) days after issuance of Defect Liability Certificate of the equipment under the contract and acceptance thereof by the Employer; provided, however, that if the Defects Liability Period has been extended on any part of the Facilities pursuant to Clause No 3.44.2 hereof, the Contractor shall issue an additional security in an amount proportionate to the Contract Price of that part. This security shall be returned to the Contractor immediately after 60 days beyond the Defects Liability period of such equipment(s).

The Bank Guarantee against CPSG submitted by the contractor as per Clause No 3.48.2 shall be discharged by the Employer and returned to the Contractor without any interest, not later than sixty (60) day after the completion of O&M contract period provided however that the entire plant is handed over by the contractor to the Employer as per provisions of the contract and acceptance by the Employer.

3.48.5. The above performance Bank Guarantees shall be issued by any Scheduled Bank / Nationalized Bank and denominated in the currency of the contract and shall be in the form of irrevocable Bank Guarantee in the format attached at Annexure-2 & Annexure- 3 of this Bid Documents.



- 3.48.6. While issuing the physical BG, the bidder's bank shall also send electronic message through secure Structured Financial Messaging System (SFMS) to the Employer Beneficiary bank whose details are provided in NIT. Bidders are advised to ensure that the message is sent by their bankers and the bidders must submit the reference details along with the bid.
- 3.48.7. The proceeds of the Bank Guarantee against CPSG shall be payable to the Employer as compensation for any loss resulting from the Contractor's failure to complete its obligations under the contract.
- 3.48.8. In case of any shortfall at any stage on account of recovery of any dues from the CPSG, Contractor shall make-up the recovered amount by furnishing a separate CPSG for such amount.
- 3.48.9. In the event of failure of the Contractor to extend the CPSG for the required period, the Employer reserves the right to invoke the CPSG in favor of Employer on the date of its expiry.
- 3.48.10. The interest @ 15.5 % per annum shall be charged on delay period for breach in timely submission of CPG without prejudice to right of MAHAPREIT to other remedies available.

#### 3.49. LIQUIDATED DAMAGES(LD) FOR EPC CONTRACT

- 3.49.1. Time is the essence of the Contract. Except otherwise specifically provided in the contract, if the performance of the Contract is delayed beyond the time schedule as specified in the Contract due to reasons attributable to the Contractor, the Employer shall, without prejudice to its other remedies under the contract, retain/recover the following damages:

##### **3.49.2. Liquidated Damages due to delay in achieving COD for each unit:**

In case of failure to achieve the milestone for commissioning as per clause no 3.17, the Contractor shall pay to the employer as Liquidated Damages and not as penalty, in the following manner:

- a) Delay up to six (6) months from Commissioning: - Liquidated Damages shall be payable at the rate of 0.05% of the total contract price of un-commissioned capacity per MW per day along with applicable GST.  
**Note-** Un-commissioned capacity means such capacity which has not been accepted by the employer.
- b) In case the commissioning of the project is delayed over six (6) months, the amount paid to the contractor in respect of capacity not commissioned shall be adjusted against any amount due to the contractor or from CPG/retention money etc. However, contractor shall be allowed to take all the balance equipment of un-utilized capacity excluding the common equipment used for commissioning of the project.

3.49.3. The total amount of liquidated damages for delay under the Clause No- 3.49.3 (a) above will be subject to a maximum of five percent (5%) of the total Contract Price along with applicable GST

**3.49.4. Liquidated Damages for PG deviation:**

During the Operational Acceptance, any shortfall in the Performance Guarantee (PG) will be determined through the PG Test Procedure specified in Technical Specifications: Section IV. Any shortfall will attract Liquidated Damages (LD) as under:

In Case the plant is not able to achieve the target generation, as per the performance guarantee procedure during the test period then the LD of an amount equivalent to loss of generation based on tariff for complete life of plant shall be applicable maximum up to 15% of the contract value of EPC Contract (First and Second Contract). Sample calculation for LD is shown in technical specification.

3.49.5. The amount of Liquidated Damages along with applicable GST shall be payable by the Contractor whenever demanded by the Employer and /or Employer can recover the amount of Liquidated Damages (to the extent leviable at any time) along with applicable GST from the amounts payable to the Contractor/Bank Guarantee available with the Employer under this contract.

**3.50. TERMS AND PROCEDURES OF PAYMENT**

**3.50.1. General**

- a) The Employer shall pay to the Contractor after signing the Contract Agreement, in the following manner and at the following terms, on the basis of the Price Break-up given in the Letter of Award subject to any deduction which the Employer may be authorized to make under this contract and/or to any additions or deductions provided for in this contract.
- b) The Contractor's request(s) for payment shall be made to the Engineer-In-Charge in writing, upon fulfillment of required obligations stipulated in the contract.
- c) The contractor shall submit the Invoice in triplicate showing description, quantity, Unit rate and total amount with all supporting documents as per terms of the contract. After due verification, the Employer shall process the verified Bill for release of payment. In case contractor fails to submit the Invoice with all the required documents, the Employer reserves the right to hold the payment against such bills.
- d) Payments shall be made by the Employer within thirty (30) days after submission of an invoice along with all supporting documents as per terms of contract by the Contractor.
- e) In case the payments in respect of amount payable as per contract is delayed beyond 45 days, the contractor will be entitled for interest on pro rata basis



(for actual period beyond 45 days) at the rate of one-year SBI MCLR applicable as on the date of payment.

- f) The contractor shall raise the invoice on monthly basis.
- g) The contractor shall ensure to make timely payments to its sub-contractor(s)/sub-vendor(s) engaged in the execution of project to ensure timely completion of works. However, in case of delayed payment/non-payment by the contractor to its approved sub-contractor(s)/sub-vendor(s), the Employer reserves the right to make direct payment to such sub-contractor(s)/sub-vendor(s) as per the terms of payment on the request of Contractor or on the request of approved sub-contractor(s)/sub-vendor(s) or otherwise, in the interest of completion of project.

### **3.50.2. Invoice Details for Taxes and duties**

Except as otherwise specifically provided in the contract, the Employer shall pay to the Contractor GST & Cess thereon, applicable if any, on submission of GST Invoice containing mainly the following contents.

- i. Name, Address & Contact Detail of the Service Provider/contractor.
- ii. GSTIN of the Service Provider/Contractor.
- iii. PAN of the Service Provider/Contractor.
- iv. GSTIN of the Employer/Owner
- v. HSN/SAC of the respective item(s)

### **3.50.3.E- Payment**

MAHAPREIT shall make all the payments in respect of Contractor through e-payment system. Contractor shall open its account with banks having Core Banking Facility (CBS Branch) and fill in Electronic Fund Transfer (EFT) Form (to be submitted at signing of Contract Agreement) and return to Employer duly signed and stamped by its bankers. In case Contractor fails to provide requisite information as sought, it may result in delay in payment for which MAHAPREIT will not be responsible. Any directions, instructions or orders issued by the Government of India from time to time regarding any or all matters arising or pertaining to the Import License shall be binding on the Contractor.

### **3.50.4. Terms of Payment**

The payment of Contract Value excluding O&M cost for the Bidder shall be made as per following:

- i. **60% (Sixty Percent)** of Price Component of the Contract of each identified equipment shall be paid, Pro-rata basis, on receipt of material at Site on production of the following: -
  - a) Application of payment along with three (3) copies of GST Invoice.
  - b) Physical Verification & discrepancy report by MAHAPREIT for the equipment/material received and stored at site. Payment shall be released after making adjustment of discrepancies only.
- ii. **10% (Ten percent)** of Price Component of the Contract shall be paid,



pro-rata basis, on completion of erection of each identified equipment upon certification by the EIC.

- iii. **15% (Fifteen percent)** of Price Component of the Contract shall be paid, pro-rata basis, on issuance of commissioning certificate of the entire plant or part thereof, as allowed by the Implementing agency (IA).
- iv. **15 % (Fifteen percent)** Price Component of the Contract shall be paid on final acceptance of the entire plant and issue of Work Completion Certificate by the Employer Note: After issuance of commissioning certificate (i.e., injecting the power into grid) and on the request of the contractor, above 15% payment may be released by EIC to the contractor against submission of BG of equivalent amount valid till final acceptance of the entire plant.



- v. The Payment towards services of O&M cost shall be paid to the Bidder on pro-rata basis at the end of each financial year after acceptance of quality standard approved by MAHAPREIT subject to adjustment of any penalty or liquidated damages liable to be adjusted from the Bidder.

3.50.5. The Bidder shall note that MAHAPREIT that the Terms of Payment as per Clause 3.50.4 as above is based on the identified project for which the NTP has been issued by MAHAPREIT.

3.50.6. Delayed Payment

Omissions on the part of the EIC to pay the amount due upon measurement or otherwise shall neither vitiate nor make the contract void. Further, no claim for interest or damages will be entertained or payable by the Employer upon any Bank Guarantee or payments in arrears or retention of amount due to non-fulfilment of obligation on the part of the contractor any balance amount (to be paid if any) which may become due on final settlement/re- conciliation of the account at the time of closure of the contract or Amount withheld by the Employer owing to any dispute or difference between the parties.

The Contractor shall be entitled to this payment without formal notice or certification, and without prejudice to any other right or remedy.

**3.50.7. Final Bill**

The final bill relating to the EPC Contract shall be prepared only when the equipment has been installed and tested for Final acceptance under Clause No 3.41 and it will include adjustment of all claims against the Contractor by the Engineer-in-Charge. The amount equivalent to losses or damages for which Contractor fails to settle claim with the insurer before completion of entire work would also be recovered from any amount due to contractor.

**3.51. CONTRACT PRICE AND PRICE ADJUSTMENT**

The bidder shall give prices of EPC contract and O&M contract for 05 years as prescribed under Bid Response Sheet I to IV except otherwise specifically mentioned in the bid document, the prices shall remain FIRM during the entire period of Contract.

**3.52. TAXES AND DUTIES**

- a) Except as otherwise specifically provided in the contract, the Contractor shall bear and pay all taxes, duties, cess, levies and charges assessed on the Contractor, by all municipal, state or central government authorities.





- b) The contractor shall furnish proof of GST registration with GSTN Portal in the State in which the Project is being executed, covering the services under this contract. Registration should also bear endorsement for the premises from where the billing shall be done by the contractor on MAHAPREIT for this project/work.
- c) Contractor shall submit to MAHAPREIT the GST compliant tax invoice/debit note/revised tax invoice on the basis of which MAHAPREIT may claim the input tax credit in its return.
- d) Tax invoice/debit Note/revised tax invoice shall contain all such particulars as prescribed in GST law.
- e) TDS under GST as applicable shall be deducted at prevailing rates from the running bills.
- f) The Contractor shall be responsible for the issuance of e-way bill and other compliances relating to e-way bill as per GST law. The existing provisions regarding road permit will continue till such time if applicable.

### 3.53. STATUTORY VARIATIONS

- 3.53.1. If, after the date seven (7) days prior to deadline for date of bid submission, in the country where the Site is located, any taxes, duties & levies (GST), 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 items in respect of direct transactions between the Employer and the Contractor and Bought out items (to be dispatched directly from the sub-vendor's works to Employer's site). This adjustment shall not be applicable on procurement of raw materials, intermediary components etc. by the Contractor.
- 3.53.2. The above adjustment however shall be restricted to schedule date of dispatch or actual whichever is less.
- 3.53.3. In the event of any change in the current status of the project after the date of submission of Price Bid and which results in reduction to the Price Bid through addition/ extension of any available benefit, drawback or concession directly resulting in reduction of liability of taxes (other than personnel taxes), the Contractor shall pass on such benefits to MAHAPREIT to the extent which is directly attributable to such change in status.



### 3.54. NEW TAXES/LEVIES

- a) In case Government imposes any new levy / tax, after the date seven (7) days prior to deadline for date of bid submission, during the tenure of the contract, MAHAPREIT shall reimburse the same at actual on submission of documentary proof of payment subject to the satisfaction of MAHAPREIT that such new levy / tax is applicable to this contract.
- b) Unless otherwise stipulated in Clause No. 3.53, any liability occurs due to, increase in the rate of GST or it is found that the actual rate of GST on any item is higher than the quoted rate, the same shall be borne by the contractor or recovered from any payment/amount due to the contractor if it is already paid/submitted or to be paid/submitted by MAHAPREIT to the statutory body/concerned authority.
- c) As regards the Indian Income Tax, Surcharge on Income Tax and any other Corporate Tax the Employer shall not bear any tax liability whatsoever. The Contractor shall be liable and responsible for payment of such tax, if attracted under the provisions of the law existing or subsequent and Employer will make tax deductions at source (TDS) as applicable.

### 3.55. DEDUCTION FROM CONTRACT PRICE

- 3.55.1. All costs, claims, damages or expenses which the Employer may have paid for which the Contractor is liable under the Contract, shall have to be refunded by the Contractor within 21 (Twenty-One) days of receipt of the bills. If the bills are not paid within the said period, this may be deducted by the Engineer-in-charge from the Performance Guarantee or from any money due or which will become due to the Contractor under this Contract.
- 3.55.2. The Employer shall be entitled to recover all dues in terms of the Contract including, but not limited to, Liquidated Damages for delay etc. by way of deductions from the payments due to the Contractor or that may become due to the Contractor in future or from any securities/guarantees under the Contract and/or otherwise.
- 3.55.3. In case of any dispute, the sum of money so obtained under this clause by the Employer will be kept withheld or retained as such by the Employer till all the claims arising out of the Contract is either mutually settled or determined by the Arbitrator, or by the competent Court, as the case may be, and that the Contractor shall have no claim for interest or damages whatsoever on this account, subject to compliance of the Govt. of India Guidelines.

### 3.56. INSURANCE

#### **3.56.1. Insurance for EPC Contract**

The Contractor shall at its expense take out and maintain in effect, or cause to be taken out and maintained in effect during the performance of the Contract, the



insurances set forth below in the sums and with the deductibles and other conditions specified below. The identity of the insurers and the form of the policies shall be subject to the approval of the Employer, who should not unreasonably withhold such approval.

- I. Cargo/Marine All Risk Insurance:** Covering loss or damage occurring, while in transit from the Contractor's or Subcontractor's works or stores until arrival at the site including unloading, to the Plant and Equipment (including spare parts thereof) and to the Contractor's Equipment.

This policy shall cover 'ALL RISKS' under and /or on deck as per Institute Cargo Clause 'A'.

- II. Erection All Risks Insurance**

Covering any physical loss or damage to the equipment during handling, transportation, storage, erection of the Facilities at the Site, occurring prior to completion of the Facilities, with extended maintenance coverage for the Contractor's liability in respect of any loss or damage occurring during the DefectsLiability Period while the Contractor is on the Site for the purpose of performing its obligations during the Defect Liability Period.

- III. Third Party Insurance**

Before receipt of equipment at site but without limiting his obligations and responsibilities under this clause hereof, the Contractor shall insure against his liability for any equipment, material, property (including the Employer's property and any parts of the facilities that have been accepted by the Employer), or physical damage covering bodily injury or death suffered by third parties (including the Employer's personnel) by or arising out of the execution of the contract or in the carrying out of contract.

- IV. Workmen's Compensation Insurance**

The contractor shall protect himself against all claims applicable under the Workmen's Compensation Act, 1923. This policy shall also cover the contractor against claims for injury, disability, disease or death of his or his sub-contractor's employees, which for any reason are not covered under the Workmen's Compensation Act, 1923. The liabilities under Workmen's Compensation Insurance shall be as per statutory provisions.

Employer shall not be liable for or in respect of any damage or compensation payable in law in respect or in consequence of any accident or injury to any workman or other person in the employment of the contractor(s) or any sub-contractor(s), save and except an accident or injury resulting from any act or default of the Employer.

3.56.1.1. The contractor shall at his own expense take out and maintain insurance cover during the performance of the contract as below:

S. No.	Insurance	Sum Insured	Deductibles	Conditions	Validity Period
A.	<b>Cargo/Marine all risk Insurance</b>	Sum of (A+B) <b>A=</b> 100% of total Plant & Equipment F.O.R price i.e., sum of the total price of <b>BRS P-II.</b> <b>B=</b> 25% of A to cover taxes & duties etc.	Minimum as per insurance policy	Open policy All risk insurance, SRCC (Strikes, Riots, Civil Commotion), terrorism etc	From 1st shipment to last shipment.
B.	<b>Storage &amp; Erection All Risk.</b>	Sum of (A+B+C) <b>A=</b> 100% of total Plant & Equipment F.O.R price i.e., sum of the total price of <b>BRS P-II.</b> <b>B=</b> 100% of Erection, Commissioning & Civil/ structural works cost as per <b>BRS P-III.</b> <b>C=</b> 25% of Sum of (A+B) to cover taxes & duties etc.	Minimum as per insurance policy	<ul style="list-style-type: none"> <li>• Installation risk, RSMD (Riots, Strikes, Malicious Damages), Earthquake Cover</li> <li>• Air Freight cover</li> <li>• Maintenance cover</li> <li>• Extra Charge Cover</li> <li>• Contractor's Plant &amp; Machinery</li> <li>• Rs. 100 Lakhs Cross Liability</li> <li>• Employer &amp; Contractor's Sub Contractor to be named as co-insured</li> <li>• Wind Gusting</li> </ul>	From commencement of work on Site to the End of Defects Liability Period
C.	<b>Third Party Liability (Extension in EAR Policy)</b>	INR 10.00 Crore Single Event Limit for bodily injury and property damage. (Ratio of 1:4)	Rs.2,50,000/- Or As per IRDAI guidelines	Contractors, subcontractors to be named as co-insured.	From commencement of work on Site to the End of Defects Liability

**Note:**

- i. The Employer shall be named as co-insured under all insurance policies taken out by the Contractor pursuant to GCC Clause 3.56 except for Third Party Liability, Workman's Compensation. Payment shall be released to the Contractor by the Insurance Company after receipt of NOC from the Employer. The appropriate Clause shall be incorporated in the Insurance Policy taken by Contractor to ensure this requirement.
- ii. In case the Contractor has taken/takes blanket insurance policy for "Erection All Risk policy" during storage and erection, such policy shall also be acceptable to Employer provided that; the name of the Employer and the



*Project is endorsed in the said policies.*

- iii. The Contractor shall provide the Engineer-in-Charge with copies of all insurance policies and documents taken out by him in pursuance of the contract. Any amendment (s) of Insurance Policies, if required, shall be informed to the Contractor by Engineer-in-In charge. The Insurance Policies shall be amended by the Contractor within 15 days of the receipt of such request. In case, Contractor fails to submit amended Insurance Policy than no future/progressive payment shall be released.*
- iv. The Contractor shall ensure that, where applicable, its Sub- contractor(s) shall take out and maintain in effect adequate insurance policies for their personnel and vehicles and for work executed by them under the Contract, unless such Subcontractors are covered by the policies taken out by the Contractor.*
- v. It shall be the responsibility of the contractor to extend the period of insurance policy (ies) if required to comply with the provisions of contract. The Engineer-in-Charge shall inform the Contractor in writing at least thirty (30) days in advance from the date of expiry for the extension of the Insurance Policy. If the Contractor fails to extend the said policy within 15 days of notice period, MAHAPREIT reserves the right to extend the said policy and the cost of the premium paid towards extension of said policy shall be recovered/deducted from the amount payable/due to the Contractor.*
- vi. The Contractor shall be responsible for preferring of all claims and make good the damages or loss by way of repairs and / or replacement of the work, damaged or lost. The Transfer of Title shall not in any way relieve the Contractor of the above responsibility during the period of contract. The Employer shall give to the Contractor all such reasonable assistance with respect to insurance claims in which the Employer's interest is involved, the Contractor shall not give any release or make any compromise with the insurer without the prior written consent of the Employer.*
- vii. Notwithstanding the insurance requirements mentioned above, it would be the Contractor's responsibility to take adequate insurance cover as may be pertinent to protect his interest and interest of the Employer. If at any point of time during execution of the Contract, the insurance policies are found to be inadequate, the Contractor shall take fresh insurance policies meeting aforesaid requirements.*
- viii. 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 make good the damages or loss by way of repairs and/or*



*replacement of plant and equipment damaged or lost and 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. Notwithstanding the extent of insurances cover and the amount of claim available from the underwriter, the contractor shall be liable to make good the full replacement/rectification of all the equipment/materials and to ensure their availability as per project requirement without additional financial liability to the Employer.*

- ix. All cost on account of insurance liabilities covered under the contract will be to the Contractor's account and will be included in contract price.*
- x. The Contractor shall arrange insurance with Indian Insurance Companies.*

### **3.56.2. Insurance for O&M contract**

#### **Insurance during Operational Acceptance and O&M Period**

The Contractor shall at its expense take out and maintain in effect the insurances set forth below during Operational Acceptance and O&M Period. The insurances provided shall be seamless with the insurance provided during the construction period by the bidder with no gap between the two:

#### **I. Fire & Allied Peril insurance**

Insurance policy for Fire and allied perils must include clauses such as earthquake, flood, storms, cyclone, tempest, hurricane, inundation, typhoon, theft & burglary and Public Liability Insurance (Third Party), burglary, reinstatement/replacement value clause, earthquake cover, and RSMTD cover.

#### **II. Workmen's Compensation Insurance**

This insurance shall protect the Contractor against all claims applicable under the

- Workmen's Compensation Act, 1948
- Workmen's Compensation Provisions.
- As per Statutory Employee's Liability Provisions.

#### **III. Comprehensive General Liability Insurance:**

The insurance shall protect the Contractor against all claims arising from injuries, disabilities, disease or death of members 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 Contractors or from riots, strikes and civil commotion.



**Note: The contractor is obliged to take all the O&M Insurances mentioned above for the project immediately after the commissioning of the plant.**

### 3.57. DELAYS BY EMPLOYER OR ITS AUTHORIZED REPRESENTATIVE(S)

- 3.57.1. In case the Contractor's performance is delayed due to any act of omission on the part of the Employer, then the Contractor shall be given due extension of time for completion of the work, to the extent such omission on the part of the Employer has caused delay in the Contractor's performance of the contract. Regarding reasonableness or otherwise of the extension of time, the decision of the Engineer -in Charge shall be final.
- 3.57.2. In addition, the Contractor shall be entitled to claim demonstrable and reasonable compensation if such delays have resulted in any increase in cost. The Employer shall examine the justification for such a request for claim and if satisfied, the extent of compensation shall be mutually agreed depending upon the circumstances at the time of such an occurrence.

### 3.58. DELAYS IN THE CONTRACTOR'S PERFORMANCE

- 3.58.1. Delivery of the Goods and performance of Services shall be made by the Contractor in accordance with the time schedule prescribed by the Employer in Bid Document.
- 3.58.2. Except as provided under Conditions of Contract Clause No 3.59, a delay by the Contractor in the performance of its obligations shall render the Contractor liable to the imposition of liquidated damages pursuant to Conditions of Contract Clause 3.49 unless an extension of time is agreed upon pursuant to Conditions of Contract Clause 3.61 without the application of liquidated damages.

### 3.59. FORCE MAJEURE

- 3.59.1. Notwithstanding the provisions of Condition of Contract Clause No. 3.49, 3.64 and 3.58, the Contractor shall not be liable for forfeiture of its Contract Performance Guarantee, liquidated damages or termination for default if and to the extent that the delay in performance or other failure to perform its obligations under the contract is the result of an event of Force Majeure.
- 3.59.2. "Force Majeure" shall mean any event beyond the reasonable control of the Employer or of the Contractor, as the case may be, and which is unavoidable notwithstanding the reasonable care of the party affected, and shall include, without limitation, the following:
- i. war, hostilities or war like operations (whether as state of war be declared or not), invasion, act of foreign enemy and civil war,
  - ii. rebellion, revolution, insurrection, mutiny, usurpation of civil or military government, conspiracy, riot, civil commotion and terrorist acts,
  - iii. confiscation, nationalization, mobilization, commandeering or requisition



by or under the order the order of any government or de jure or de facto authority or ruler or any other act or failure to act of any local state or national government authority,

- iv. sabotage, embargo, import restriction, port congestion, lack of usual means of public transportation and communication, shipwreck, shortage or restriction of power supply, epidemics, quarantine and plague; but does not include any strike/ lockout and any type of agitation/gherao/dharna by local communities causing restriction/blockade to the 'right of way' to the site or causing hindrance to the working of the Project,
- v. earthquake, landslide, volcanic activity, fire, flood/ flash flood or inundation, tidal wave, typhoon or cyclone, hurricane, storm, lightning, or other inclement weather condition, nuclear and pressure waves or other natural or physical disaster; but does not include incessant rain,
- vi. Shortage of labour, materials or utilities were caused by circumstances that are themselves Force Majeure

3.59.3. If a Force Majeure situation arises, the Contractor shall promptly notify MAHAPREIT in writing of such condition and the cause thereof. Unless otherwise directed by MAHAPREIT in writing, the Contractor shall continue to perform its obligations under the contract as far as is reasonably practical, and shall seek all reasonable alternative means for performance not prevented by the Force Majeure event.

3.59.4. The Contractor or MAHAPREIT shall not be liable for delays in performing their respective obligations resulting from and to the extent applicable and necessitating rescheduling, if any, of the balance critical activities to any Force Majeure causes as referred to and/or defined above. The date of completion will, be extended by a reasonable and justifiable time.

3.59.5. The delay in fulfilment by the Parties of their obligations under this Contract shall not exceed the duration of Force-Majeure circumstances and also their consequences.

3.59.6. If the performance of the contract is delayed for more than six (6) months for one of the reasons mentioned above, the performance of contract shall be continued on mutual terms & conditions.

3.59.7. Force majeure shall not apply to MAHAPREIT's obligations to make payment for the work done under the contract.

3.59.8. The contractor shall not claim any compensation for force majeure conditions and shall take appropriate steps to ensure man & material utilized by it under the contract well in advance.

### 3.60. SUSPENSION OF WORK

3.60.1. The Employer reserves the right to suspend and reinstate execution of the whole or any part of the work. Order for suspension or reinstatement of the works will





be issued by the Engineer-in-charge to the Contractor in writing. The Time for Completion of the works will be extended for a period equal to the duration of the suspension.

- 3.60.2. Any necessary and demonstrable costs incurred by the Contractor, as a result of such suspension of the works, will be paid by the Employer, provided that such costs are substantiated to the satisfaction of the Employer. The Employer shall not be responsible for any liabilities if suspension or delay is due to some default on the part of the Contractor or his Sub-Contractor

### 3.61. EXTENSION OF TIME FOR COMPLETION

- 3.61.1. Except where otherwise specifically provided in the Contract, if at any time during performance of the contract, the Contractor should encounter conditions impeding timely delivery of the Goods/execution of the contracts, the Contractor shall promptly notify the Employer in writing of the fact of the delay, its likely duration and its cause(s) together with particulars of the event or circumstance and supporting documents/data/records, hindrance register, evidence(s) justifying such extension as soon as reasonably practicable after the commencement of such event or circumstance. Following documents shall become principal basis for consideration of time extension:

- i. Records maintained in the Hindrance Register
- ii. Minutes of Weekly Project Review Meeting
- iii. Minutes of Monthly Project Review Meeting
- iv. Written notices issued by EIC or his authorized representative to contractor in relevant period

As soon as practicable after receipt of the Contractor's notice, the Employer shall evaluate the situation and may at its discretion extend the Contractor's time for performance, with or without levy of Liquidated Damages, in which case the extension shall be ratified by the parties by amendment of the contract.

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

### 3.62. BANKRUPTCY

- 3.62.1. If the Contractor shall become bankrupt or have a receiving order made against him or compound with his creditors, or being a Corporation commence to be wound up, not being a voluntary winding up for the purpose only of amalgamation reconstruction, or carry on its business under a receiver for the benefit of its creditors or any of them, the Employer will be at liberty.

- a) To terminate the contract forthwith by notice in writing to the liquidator or receiver or to any person in whom the contract may become vested and to act in the manner entitled 'Contractor's Default', as though the last-mentioned notice has been the notice referred to in such clause and the equipment and materials



have been taken out of the Contractor's hands

- b) To give such liquidator, receiver, or other person the option of carrying out the contract subject to his providing a guarantee, for the due and faithful performance of the contract, up to an amount to be determined by the Employer.

### 3.63. CONTRACTOR'S DEFAULT

- 3.63.1. If the Contractor shall neglect to execute the works with due diligence and expedition or shall refuse or neglect to comply with any reasonable orders given to him in writing by the Engineer- in-charge in connection with the works, or shall contravene the provisions of the Contract, the Employer may give notice of default, in writing to the Contractor to make good the failure, neglect or contravention complained of. Should the Contractor fail to comply with the notice within thirty (30) days or otherwise, for a period of time as may be decided by the Engineer-in-charge from the date of service thereof, then and in such a case, the Employer shall be at liberty to employ other workmen and forthwith execute such part of the works as the Contractor may have neglected to do or, if the Employer shall think fit, without prejudice to any other right he may have under the Contract, to take the works wholly or in part out of the Contractor's hand and enter into a separate Contract with any other person or persons to complete the works or any part thereof. In such event, the Employer shall have free use of all the Contractor's equipment that may have been at that time at the site in connection with the works, without being responsible to the Contractor for wear and tear thereof and to the exclusion of any right of the Contractor over the same, and the Employer shall be entitled to retain and apply any balance which may otherwise be due under the Contract by him to the Contractor ,or such part thereof as may be necessary, to the payment of cost of executing the said part of the works or of completing the works, as the case may be. If the cost of completing the works or executing a part thereof as aforesaid shall exceed the balance due to the Contractor, the Contractor shall pay such excess amount. Such payment of excess amount shall be independent of the Liquidated Damages for delay that the Contractor shall have to pay if the completion of works is delayed.
- 3.63.2. In addition, such action by the Employer as aforesaid shall not relieve the Contractor of his liability to pay Liquidated Damages for delay in completion of works as defined in the Contract.
- 3.63.3. The termination of the Contract under this Clause shall not entitle the Contractor to reduce the value of the Contract Performance Guarantee nor the time thereof. The Performance Guarantee shall be valid for the full value and for the full period as originally stipulated in the Contract, including Guarantee Period.



### 3.64. TERMINATION OF CONTRACT ON CONTRACTOR'S DEFAULT

- 3.64.1. MAHAPREIT, without prejudice to any other remedy for breach of contract, by written notice of default sent to the Contractor, by registered A/D may terminate this contract in whole or in part in any of the following cases:
- (a) If the Contractor fails to perform any obligation(s) under the contract or
  - (b) If the Contractor, in the judgment of MAHAPREIT has engaged in corrupt or fraudulent practices in competing for or in executing the contract.
- 3.64.2. In the event MAHAPREIT terminates the contract in whole or in part, pursuant to Condition of Contract Clause 3.64.1, MAHAPREIT may procure, upon such terms and in such manner as it deems appropriate, Goods or Services similar to those undelivered at the risk and cost of the Contractor and without any prejudice to any right of the Employer provided in the Contract. The Contractor shall be liable to MAHAPREIT for any excess costs for such similar Goods or Services. However, the Contractor shall continue performance of the contract to the extent not terminated. The Contractor, however, shall under no circumstances, be entitled to any gain on account of such action by the Employer
- 3.64.3. In case of termination of the contract due to contractor's default, the contractor may be debarred from participation in future tenders by the employer, through a communication in writing for a period to be specified therein.

### 3.65. TERMINATION OF THE CONTRACT ON THE EMPLOYER'S INITIATIVE

- 3.65.1. The Employer reserves the right to terminate the Contract either in part or in full due to reasons other than those mentioned under the Clause No 3.63 & 3.64 of this Bid Document. The Employer, shall, in such an event, give 30 (Thirty) days' notice in writing to the Contractor of his decision to do so.
- 3.65.2. The Contractor, upon receipt of such notice, shall discontinue the work on the date and, to the extent specified in the notice, make all reasonable efforts to obtain cancellation of all orders and Contracts to the extent they are related to the work terminated and upon terms favourable to the Employer, stop all further sub-Contracting or purchasing activity related to the work terminated, and assist the Employer in maintenance, protection and disposition of the works acquired under the Contract by the Employer.
- 3.65.3. In the event of such termination, the Contractor shall be paid compensation, equitable and reasonable dictated by the circumstances prevalent at the time of termination, as decided by the Employer.

### 3.66. TERMINATION DUE TO INSOLVENCY

- 3.66.1. The Employer may at any time terminate the contract by giving written notice to the Contractor if the Contractor becomes bankrupt or otherwise insolvent. In this event, termination will be without compensation to the Contractor, provided



that such termination will not prejudice or affect any right of action or remedy which has accrued or will accrue thereafter to the Employer.

### 3.67. FORECLOSURE OF CONTRACT IN FULL OR PART DUE TO ABANDON OR REDUCTION IN SCOPE OF WORK

3.67.1. If at any time after acceptance of the Bid the Employer decides to abandon or reduce the scope of the works for reason whatsoever and hence does not require the whole or any part of the work to be carried out, the Engineer-In-Charge shall give notice in writing to that effect to the Contractor and the Contractor shall have no claim to any Payment of compensation or otherwise whatsoever, on account of any profit or advantage which he might have derived from the execution of the works in full but which he could not derive in consequence of the foreclosure of the whole or part of the works. The Contractor shall be paid at Contract rates for actual amount of the works executed at site

### 3.68. SETTLEMENT OF DISPUTES

#### 3.68.1. ADJUDICATOR

- i. If any dispute of any kind whatsoever shall arise between the Employer 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.
- ii. The dispute adjudication board (DAB) shall consist of either one or three suitably qualified persons ("the Members").
- iii. 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.
- iv. 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 Employer or the Contractor within one hundred eighty (180) days of such reference, the decision shall become final and binding upon the Employer and the Contractor. Any decision that has become final and binding shall be implemented by the parties forthwith.
- v. Should the Adjudicator resign or die, or should the Employer and the Contractor agree that the Adjudicator is not fulfilling its functions in accordance with the

provisions of the Approvals 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 CMD, MAHAPREIT Ltd). 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 Employer and the Contractor.

### **3.68.2.ARBITRATION**

- a) If either the Employer or the Contractor is dissatisfied with the Adjudicator's decision, or if the Adjudicator fails to give a decision within twenty-eight (28) days of a dispute being referred to it, then either the Employer or the Contractor may, within one hundred eighty (180) days of such reference, give notice to the other party, of its intention to commence arbitration, as hereinafter provided, as to the matter in dispute, and no arbitration in respect of this matter may be commenced unless such notice is given.
- b) Any dispute in respect of which a notice of intention to commence arbitration has been given, in accordance with the above clause, shall be finally settled by arbitration. Arbitration may be commenced prior to or after completion of the Facilities.

**c) In case the Contractor is a Public Sector Enterprise or a Government Organization/Department:**

In the event of any dispute or difference relating to the interpretation and applications of the provisions of commercial contract(s) between Central Public Sector Enterprises (CPSEs)/ Port Trusts inter se and also between CPSEs and Government Departments/Organizations(excluding disputes concerning Railways, Income Tax, Customs & Excise Department) such dispute or difference shall be taken up by either party for resolution through AMRCD (Administrative mechanism for resolution of CPSEs Disputes) as mentioned in DPE OM No. 4(1)/2013-DPE (GM)/FTS-1835 dated 22-05- 2018 and any subsequent amendment(s) issued from time to time.

**d) In case the contractor is not a Public Sector Enterprise or a Government Department/Organization:**

Any dispute submitted by a party to arbitration shall be heard by an arbitration panel composed of three arbitrators, in accordance with the provisions set forth below:

- a) The Employer and the Contractor shall each appoint one arbitrator, and these two arbitrators shall jointly appoint a third arbitrator, who shall chair the arbitration panel. If the two arbitrators do not succeed in appointing a third arbitrator within twenty-eight (28) days after the latter of the two arbitrators has been appointed, the third arbitrator shall, at the request of either party, be appointed by the Appointing Authority for arbitrator (the CMD, MAHAPREIT Limited).



- b) If one party fails to appoint its arbitrator within forty-two (42) days after the other party has named its arbitrator, the party which has named an arbitrator may request the Appointing Authority to appoint the second arbitrator.
- c) If for any reason an arbitrator is unable to perform its function, the mandate of the Arbitrator shall terminate in accordance with the provisions of applicable laws and a substitute shall be appointed in the same manner as the original arbitrator.
- d) Arbitration proceedings shall be conducted in accordance with the Arbitration and Conciliation Act, 1996 and any amendment(s) thereto as issued by the Govt of India from time to time. The venue of arbitration shall be at Mumbai / Delhi/ the place where the Solar Power Project is located.
- e) The decision of a majority of the arbitrators (or of the third arbitrator chairing the arbitration, if there is no such majority) shall be final and binding and shall be enforceable in any court of competent jurisdiction as decree of the court. The parties thereby waive any objections to or claims of immunity from such enforcement.
- f) The arbitrator(s) shall give reasoned award.
- g) Notwithstanding any reference to the arbitration herein, the parties shall continue to perform their respective obligations under the Contract unless they otherwise agree.

### 3.69. GOVERNING LANGUAGE

3.69.1. The bid prepared by bidder and all correspondence/ drawing/ documents relating to the bid between bidder and MAHAPREIT shall be written in English language only. In case the literature is furnished in another language, same may be accompanied by English translation duly authenticated by the authorized translator. The English version shall govern in case of any variation.

### 3.70. APPLICABLE LAW/ JURISDICTION

3.70.1. The Contract shall be governed by and interpreted in accordance with the laws of land. The Courts governing the territorial jurisdiction of the Solar Power Project shall have exclusive jurisdiction in all matters arising under the contract.

### 3.71. TRANSFER OF OWNERSHIP

3.71.1. The title of the equipment and materials supplied by the Contractor would be transferred to MAHAPREIT/SPV upon receiving the goods at site. This Transfer of Title shall not be construed to mean the acceptance and the consequent "Final Acceptance" of equipment and material. The Contractor shall continue to be responsible for the quality and performance of such



equipment and material and for their compliance with the specification during the entire period of the performance of the contract.

- 3.71.2. This transfer of Title shall not relieve the Contractor from the responsibility of all risks of loss and damage to the equipment and material as specified under the Clause No 3.19 of this Bid Document.

### 3.72. INDEMNITY TO MAHAPREIT

- 3.72.1. The Contractor shall at all times indemnify and keep indemnified MAHAPREIT against all losses and claims for injuries or damages to any person or property whatsoever which may arise out of consequence of the execution of the works and against all claims, demands, proceedings including civil and criminal, damages, cost, charges and expenses whatsoever in the respect of or in settlement thereto.
- 3.72.2. The Contractor shall at all times indemnify MAHAPREIT against any claim which may be made under Workmen's Compensation Act or any statutory modifications thereof or otherwise for or in respect of any damage or compensation payable in consequence of any accident or injury sustained by any workman or other person whether in the employment of the Contractor or not.
- 3.72.3. The Contractor shall at all times keep MAHAPREIT indemnified against all claims, damages or compensation under the provisions of payment of Wages Act, 1936, Minimum Wages 1948, Employees Liability Act 1938, The Workmen's Compensation Act, 1923, Equal remuneration Act-1976, Employment of Child Labor Act -1938, Abolition of bonded labor Act and the Contract Labour (Regulation and abolition) Act-1970 or any other Acts regulating the employment of Labour by Contractor.
- 3.72.4. The Contractor shall at all times indemnify MAHAPREIT against all claims which may be made in respect of the plant and machinery for infringement of any right protected by patent, registration of design and trade mark. Provided always that in the event of any claim in respect of any alleged breach of patent, registered designs or trade mark made against MAHAPREIT, the same shall be notified to the Contractor and Contractor shall at his own cost either settle any such dispute or conduct any litigation that may arise there from

### 3.73. LAW PERTAINING TO LABOUR

- 3.73.1. This contract shall be governed by the various Labour Laws for the time being in force in India or in the state where the project is located. The Contractor shall be responsible for compliance of all applicable central, state & municipal laws, Panchayat Raj Act & rules & legislation in force from time to time at work site & shall be solely responsible to comply with all obligations & payments there under.



- 3.73.2. No compensation will be entertained for the liabilities arising out of any provision of any act, Law, rules, & legislation in force from time to time pertaining to labour. In case MAHAPREIT is liable to pay any charges/penalty arising out of noncompliance by the Contractor, the same shall be recovered from the Contractor.
- 3.73.3. The contractor shall provide an updated list of sub-contractors and their laborers every month and ensure that all the payments are made to the Subcontractor/vendors using digital payment methods.

#### 3.74. COMPLIANCE WITH REGULATIONS

- 3.74.1. Unless otherwise specified, all works / supply, to the extent applicable, shall be carried out in accordance with the Indian Electricity Act, 2003, the Indian Electricity Rules, 1956 or any amendment / order thereof, which may be issued during the currency of the Contract and the requirements of any other Rules, Regulations and Act in India to which the Employer may be subjected to.
- 3.74.2. The Contractor shall comply with all applicable laws, or ordinances, codes, approved standards, rules and regulations and shall procure all necessary Municipal and Government permits, licenses etc., at his own cost. The Contractor shall leave the Employer and Engineer-in-charge harmless as a result of any infraction thereof.

#### 3.75. REGULATIONS OF LOCAL AUTHORITIES

- 3.75.1. The Contractor shall, throughout the continuance of the Contract and in respect of all matters arising out of the performance thereof, comply the laws, rules and regulations of the Local Authorities. The contractor shall also comply with the Minimum Wages Act, 1948, Payment of Wages Act 1936, the Contract (Regulation and Abolition) Act 1970 and other Act, Laws, Rules and Regulations applicable in performance of the Contract. All registrations, permissions, inspections, rights etc., required for execution of the Contract shall be arranged by the Contractor himself at his own cost. The Employer will provide the necessary documentary assistance to the extent possible, in obtaining the same. The Employer shall not, be responsible for delay on this account.
- 3.75.2. If, under any statute/law, any registration, permission, inspection, right etc., is required to be arranged specifically by the Employer, this shall be brought to the notice of the Employer by the Contractor along with the Bid.

#### 3.76. NOTICES

- 3.76.1. Any notice given by one party to the other pursuant to this contract shall be sent to the other party in writing or by E-mail or facsimile and confirmed in writing to the other party's address specified in Contract Document.
- 3.76.2. A notice shall be effective when delivered or on the notice's effective date, whichever is later.





### 3.77. ENVIRONMENTAL LAWS

3.77.1. The Contractor shall comply with all applicable codes, laws, rules and regulations relating to actual or potential effect of the activities on and at the project contemplated by executing this project on the environment, the disposal of material, the discharge of chemicals, gases or other substances or materials into the environment, or the presence of such materials, chemicals, gases or other substances in or on the project.

### 3.78. DISPOSAL OF SCRAP

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

3.78.2. The term 'Scrap' shall refer to scrap/waste/remnants arising out of the unpacking of equipment, construction debris, 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.

3.78.3. The disposal of such Scrap shall vest with the Contractor for the items supplied by contractor and issued by the Employer under this contract for installation and construction without any adjustment to the Contract Price. 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 taxes/duties shall be that of the Contractor.

3.78.4. The Contractor shall also indemnify to keep the Employer 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 as Annexure 6 of Section-V: Bid Response Sheets and Annexures). Further, in case the laws require the Employer 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 Employer.

### 3.79. POWER OF ENTRY

3.79.1. In case the Contractor does not execute the work in the manner described in the contract documents or if he shall at any time in the opinion of the Engineer-in-Charge:

- a. Fail to operate & maintain the plant in conformity with contract document or
- b. Substantially suspend work or the works for a continuous period of 15 days without permission from the engineer in charge, or



- c. Fail to carry on and execute the works to the satisfaction of the engineer in charge, or
  - d. Commit or suffer or permit any other breach of any of the provisions of the contract on his part to be performed, or
  - e. If the Contractor abandons the works, or
  - f. If the Contractor during the continuance of the contract becomes bankrupt.
- 3.79.2. In any of such events, MAHAPREIT shall have the power to revoke the Contract Agreement to operate and maintain the plant. Contractor shall vacate the project premises immediately and shall have no right of entry thereafter. MAHAPREIT will de-facto control the plant, materials, spares, equipment, tools, stocks etc. and continue to have access to common facilities thereon.

### 3.80. VACATION OF THE PROJECT PREMISES AFTER EXPIRY OF TERM

- 3.80.1. After the expiry of the period of contract or extension thereof as the case may be, Contractor shall ensure that the plant is in operationally fit and running condition.
- 3.80.2. While vacating the project premises, Contractor shall hand over all technical documents, literature, and instruction manuals, lists of spare parts, tools & tackles etc. Contractor shall also hand over all the relevant record/documents.

### 3.81. SCHEDULING AND FORECASTING

- 3.81.1. The contractor shall be responsible for scheduling & forecasting for the Solar power project on behalf of the Employer as specified elsewhere in the Contract documents, to comply with statutory requirements, Regulations, Orders etc as per applicable Regulations, guidelines, Orders etc issued by CERC/SERC/STU/CTU/SLDC /designated agencies. Contractor shall provide Communication Connectivity of pooling station to STU/CTU Grid for the purpose of scheduling & forecasting.

### 3.82. DEFECTS/ NON-ACHIEVEMENT OF PLANT DEPENDABLE CAPACITY AT THE TIME OF VACATING PROJECT PREMISES

- 3.82.1. In order that the Contractor could obtain a Vacation Certificate, he shall rectify any defect / non- achievement of plant dependable capacity in accordance to the norms of manufacturer arising from the defective Operation & maintenance practices or noncompliance of Prudent Utility Practices or that may have been noticed or developed during/ after the project premises has been vacated, the period allowed for carrying out such works will be normally one month. If any defect could not be remedied or plant dependable achievement capacity in accordance to the norms of manufacturer could not be achieved within a reasonable time, MAHAPREIT may proceed to do the work at Contractors risk and cost and recover such amount, as may be decided by MAHAPREIT from any



amount due. Non-realization of such amount shall not debar MAHAPREIT to recover the amount through Court of Law.

3.82.2. All the aforesaid safeguards /rights provided for MAHAPREIT shall not prejudice its other rights/remedies elsewhere provided herein and/or under law.

### 3.83. GRAFTS AND COMMISSIONS ETC

3.83.1. Any graft, commission, gift or advantage given, promised or offered by or on behalf of the Contractor or his partner, agent, officers, director, employee or servant or any one on his or their behalf in relation to the obtaining or to the execution of this or any other contract with the Employer, shall, in addition to any criminal liability which it may incur, subject the Contractor to the cancellation of this and all other contracts and also to payment of any loss or damage to the Employer resulting from any cancellation. The Employer shall thus be entitled to deduct the amounts so payable from any monies otherwise due to Contractor under the contract.

### 3.84. CORRUPT AND FRAUDULENT PRACTICE

3.84.1. "Fraudulent Practice" means a misrepresentation of facts in order to influence a procurement process or the execution of a contract to the detriment of the Employer and includes collusive practice among Bidders (prior to or after Bid submission) designed to establish bid prices at artificial non-competitive levels and to deprive the Employer of the benefits of free and open competition.

3.84.2. "Corrupt Practice" means the offering, giving, receiving or soliciting of anything of value to influence the action of a public official in the procurement process or in contract execution.

3.84.3. "Collusive practice" means a scheme or arrangement between two or more Bidders, with or without the knowledge of the Employer, designed to establish bid prices at artificial, non- competitive levels.

3.84.4. "Coercive Practice" means harming or threatening to harm, directly or indirectly, persons or thereto influence their participation in the procurement process or affect the executive of a contract.

### 3.85. LIMITATION OF LIABILITY

3.85.1. Except in cases of criminal negligence or wilful misconduct,

a) the Contractor shall not be liable to the Employer, whether in contract, tort, or otherwise, for any indirect or consequential loss or damage, loss of use, loss of production, or loss of profits or interest costs, provided that this exclusion shall not apply to any obligation of the contractor to pay liquidity damages to the employer and

b) the aggregate liability of the Contractor to the employer, whether under the contract, in tort or otherwise, shall not exceed the total contract price, provided that this limitation shall not apply to any obligation of the



contractor to indemnify the employer with respect to patent infringement.

**\*\*\*\*\*END OF SECTION\*\*\*\*\***



## **SECTION – IV**

# **BID RESPONSE SHEETS (BRS) & ANNEXURES**



## BID FORM

To

Chief General Manager (SEP) (Designation)

Mahatma Phule Renewable Energy & Infrastructure Technology Limited.

B-501 Pinnacle Corporate Park, Next to Trade Center,

BKC, Bandra (East), Mumbai – 400051

**Subject:** Design, Engineering, Supply, Construction, Erection, Testing, Commissioning, and five (05) years comprehensive Operation & Maintenance of 50 MW(AC) grid connected solar PV power plant in the state of Maharashtra.

Dear Sir,

After examining / reviewing the Bid Documents for Notice inviting tender for Design, Engineering, Supply, Construction, Erection, Testing, Commissioning, and Five (05) years comprehensive Operation & Maintenance of 50 MW(AC) grid connected solar PV power plant in the state of Maharashtra vide Bid Documents No –

\_\_\_\_\_ comprising "Notice Inviting Tender", "Instructions to Bidders", "Technical Specification", "Conditions of Contract", "Bid Response Sheets [BRS], Attachments & Annexures" etc., including amendments/ addendums/ corrigendum / clarifications to the Bid Documents, the receipt of which is hereby duly acknowledged, we, the undersigned Bidder, express to execute the whole part of the work in conformity with the said Bid Documents.

1. We hereby confirm that this Bid is valid for a period of 180 Days "from the last date of bid closing as per NIT or any extension thereof", and it shall remain binding upon us and may be accepted by any time before the expiry of that period.
2. Until a final Agreement is prepared and executed, the Bid together with your written acceptance thereof in your Letter of Award shall constitute a binding Agreement between us.
3. We understand that Bid Documents is not exhaustive and any action and activity not mentioned in Bid Documents but may be inferred to be included to meet the intent of the Bid Documents shall be deemed to be mentioned in Bid Document unless otherwise specifically excluded and we confirm to perform for fulfilment of "Agreement" and completeness of the Work in all respects within the time frame and agreed price.

#### **4. ATTACHMENTS TO THE BID FORM**

In line with the requirement of the Bid Document, we enclose herewith the following Attachments to the Bid Form:

##### **I. Attachment-1: Power of Attorney**

A power of attorney, as per Clause No 2.13.3, indicating that the person(s)

signing the Bid has the authority to sign the Bid and that the Bid is binding upon the Bidder during the full period of its validity in accordance with Clause No 2.12.

- II. Attachment-2: Submission of GST Details**  
Bidders have to submit the GST details of their company at Attachment- 2 of Section-IV: BRS & Annexures of this Bid Document.
- III. Attachment-3: Bid Security/Earnest Money Deposit requirement**  
Bidder shall submit the Bid security/EMD requirement as per format specified at Annexure-7 of Section-IV: BRS & Annexures of this Bid Document.
- IV. Attachment-4:Pre- Contract Integrity Pact**  
Integrity Pact duly signed between Employer and the Bidder in accordance with Clause No 2.30.
- V. Attachment-5: Declaration regarding Blacklisting**
- VI. Attachment-6: No Deviation Certificate**  
The Bidders shall submit a "No Deviation Certificate" to the updated bidding document in accordance with Clause No 2.13 of this Bid Document.
- VII. Attachment-7: Electronic Fund Transfer (EFT) details of the Bidder.**
- VIII. Attachment-8: Technical Criteria**  
Bidder shall submit the technical data in the prescribed format along with scanned copy of all the supporting documents to demonstrate fulfillment of the eligibility criteria as per Clause No. 1.4 of this Bid Document.
- IX. Attachment-9: Financial Criteria**  
Bidder shall submit the financial data in the prescribed format along with scanned copy of all the supporting documents to demonstrate fulfillment of the eligibility criteria as per Clause No. 1.4 of this Bid Document.
- X. Attachment-10: Net Annual Guaranteed Generation for the proposed Solar PV Power Plant**  
Bidder shall quote the Net Annual Guaranteed Generation for first year to be determined as per Appendix-A to Attachment-10 along with the documentary proof for arriving at the Declared Net Annual Guaranteed Generation (NAGG) such as Energy Estimation Report using the latest software such as PV Syst, Meteonorm for each unit for which the bidder is seeking qualification.
- XI. Attachment -11: Time Schedule**  
Bidder shall submit the detailed activity wise Time schedule (L1 Schedule) for each unit for which the bidder is seeking qualification in the form of PERT Chart covering all aspects like ordering, site preparation, Supply, erection, installation, testing & commissioning, etc. along with the bid.
- XII. Attachment-12: List of Vendors/sub-contractors proposed to be engaged.**



- XIII. Attachmnt-13: Mandatory Information to be submitted by the Bidder.**
- XIV. Attachment 14: Format for Month Wise Target Generation for the proposed Solar PV Power Plant**
- XV. Attachment -15: Undertaking regarding restrictions imposed by the Government of India.**
- XVI. Attachment -16: Declaration for compliance to ALMM.**
- XVII. Attachment -17: Estimated Bill of Quantities**
- XVIII. Attachment-18: Schedule of Tools & Tackles for Erection, Testing, Commissioning and O&M for each unit for which the bidder is seeking qualification.**
- XIX. Attachment no 19: Declaration regarding Import Content.**

### **PRICE SCHEDULES**

In line with the requirements of the Bid Document, we confirm that we have uploaded the price schedule in electronic form in e-tendering portal & will submit the following Price Schedules

- a) **PBRS No-I:** Summary of Prices
- b) **PBRS No II:** Schedule of Price for Supply of Plant and Equipment at site complete in all respect.
- c) **PBRS No III:** Schedule of Price for Comprehensive Operation & Maintenance of the SolarPV Power Project for 5 years from the Commercial Operation Date (COD) including O&Mspares and consumables.
- d) **PBRS No IV:** Schedule of applicable existing GST Rate on the equipment supplied under the First Contract, Second and third contract (as on the date seven (7) days prior to deadline for date of submission of Bids).

**Place:**

**Name:**

**Date:**

**Designation:**

**Name of Company:**





Duly authorized to sign Bid for and on behalf of\_\_\_\_(name of firm/company)

Business Address for communication :  
Telephone No :  
Fax No :  
E-mail address :  
Legal status : Company/Firm:  
Place of incorporation :



## **ATTACHMENT 1**

### **POWER OF ATTORNEY**

Bidder to furnish Power of Attorney in accordance with ITB Clause No 2.13.3 of this Bid Document.



## **ATTACHMENT 2**

### **GST DETAILS**

Bidders have to submit the GST details of their company.

**(Name and Signature of the Authorized Signatory)**



**ATTACHMENT 3**

**COST OF BID DOCUMENT & BID SECURITY/EARNEST MONEY DEPOSIT**

**Bidder to furnish Bid Security in line with ITB Clause 1.8 and as per Format  
Given at Annexure-7 Section-IV (Annexures)**

**(BID SECURITY IN SEPARATE SEALED ENVELOPE)**

**(Name and Signature of the Authorized  
Signatory)**



## ATTACHMENT 4

### **FORMAT FOR PRE-CONTRACT INTEGRITY PACT**

#### **Between**

\_\_\_\_\_, a company incorporated under the relevant law in the matter and having its registered office at \_\_\_\_\_, hereinafter referred to as "The Employer" which expression shall mean and include, unless the context otherwise requires, his successors in office and assigns of the **First Part**.

#### **AND**

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

WHEREAS the Employer proposes to procure under laid down organizational procedures, contract/s for (Name of the work/ goods/ services) and the Bidder/Contractor is willing to offer against NIT No. MAHAPREIT/SEP-02/06-23

NOW, THEREFORE,

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

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

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

#### **1. COMMITMENTS OF THE EMPLOYER**

- 1.1. The Employer undertakes that no official of the Employer, connected directly or indirectly with the contract, will demand, take a promise for or accept, directly or

through intermediaries, any bribe, consideration, gift, reward, favour or any material or immaterial benefit or any other advantage from the Bidder/Contractor, either for themselves or for any person, organization or third party related to the contract in exchange for an advantage in the bidding process, bid evaluation, contracting or implementation process related to the contract.

- 1.2. The Employer will, during the pre-contract stage, treat all the Bidders/Contractors alike, and will provide to all the Bidders/Contractors the same information and will not provide any such information to any particular Bidder/Contractor which could afford an advantage to that particular Bidder/Contractor in comparison to other Bidders/Contractors.
- 1.3. All the officials of the Employer will report to the appropriate Authority any attempted or completed breaches of the above commitments as well as any substantial suspicion of such a breach.
- 1.4. In case any such preceding misconduct on the part of such official(s) is reported by the Bidder to the Employer with full and verifiable facts and the same is prima facie found to be correct by the Employer, necessary disciplinary proceedings, or any other action as deemed fit, including criminal proceedings may be initiated by the Employer or Independent External Monitor and such a person shall be debarred from further dealings related to the contract process. In such a case while an enquiry is being conducted by the Employer the proceedings under the contract would not be stalled.

## **2. COMMITMENTS OF THE BIDDER(S)/CONTRACTOR(S)**

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

- 2.1 The Bidder(s)/Contractor(s) will not offer, directly or through intermediaries, any bribe, gift, consideration, reward, favour, any material or immaterial benefit or other advantage, commission, fees, brokerage or inducement to any official of the Employer, connected directly or indirectly with the bidding process, or to any person, organization or third party related to the contract in exchange for any advantage in the bidding, evaluation, contracting and implementation of the contract.
- 2.2 The Bidder/Contractor further undertakes that it has not given, offered or promised to give, directly or indirectly any bribe, gift consideration, reward, favour, any material or immaterial benefit or other advantage, commission, fees, brokerage or inducement to any official of the Employer or otherwise in procuring the Contract or forbearing to do or having done any act in relation to the obtaining or execution of the contract or any other contract with Employer for showing or forbearing to

show favour or disfavour to any person in relation to the contract or any other contract with Employer.

- 2.3 The Bidder(s)/Contractor(s) shall disclose the name and address of agents and representatives and Indian Bidder(s)/Contractor(s) shall disclose their foreign principals or associates.
- 2.4 The Bidder(s)/Contractor(s) shall disclose the payments to be made by them to agents/brokers or any other intermediary, in connection with this bid/contract
- 2.5 The Bidder, either while presenting the bid or during pre-contract negotiations or before signing the contract, shall disclose any payments he has made, is committed to or intends to make to officials of the Employer or their family members, agents, brokers or any other intermediaries in connection with the contract and the details of services agreed upon for such payments.
- 2.6 The Bidder/Contractor will not collude with other parties interested in the contract to impair the transparency, fairness and progress of the bidding process, bid evaluation, contracting and implementation of the contract.
- 2.7 The Bidder/Contractor will not accept any advantage in exchange for any corrupt practice, unfair means and illegal activities.
- 2.8 The Bidder/Contractor shall not use improperly, for purposes of competition or personal gain, or pass on to others, any information provided by the Employer as part of the business relationship, regarding plans, technical proposals and business details, including information contained in electronic data carrier. The Bidder/Contractor also undertakes to exercise due and adequate care lest any such information is divulged.
- 2.9 The Bidder(s)/Contractor(s) commits to refrain from giving any complaint directly or through any other manner without supporting it with full and verifiable facts.
- 2.10 The Bidder(s)/Contractor(s) shall not instigate or cause to instigate any third person to commit any of the actions mentioned above.
- 2.10 If the Bidder/Contractor or any employee of the Bidder/Contractor or any person acting on behalf of the Bidder/Contractor, either directly or indirectly, is a relative of any of the officers of the Employer, or alternatively, if any relative of an officer of the Employer has financial interest/stake in the Bidder(s)/Contractor(s) firm (excluding Public Ltd. Company listed on Stock Exchange), the same shall be disclosed by the Bidder/Contractor at the time of filling of tender.
- 2.11 The term 'relative' for this purpose would be as defined in Section 2(77) of the Companies Act 2013.
- 2.12 The Bidder(s)/Contractor(s) shall not lend to or borrow any money from or enter into any monetary dealings or transactions, directly or indirectly, with any employee of the Employer.
- 2.13 The Bidder/supplier shall follow all rules and regulations of India including statutory requirements like minimum wages, ESIC and EPF.



### **3. PREVIOUS TRANSGRESSION**

- 3.1 The Bidder(s)/Contractor(s) declares that no previous transgression occurred in the last three years immediately before signing of this Integrity Pact, with any other company in any country in respect on any corrupt practices envisaged hereunder or with any Public Sector Enterprise / Government Department in India and in (Employer's country).
- 3.2 The Bidder agrees that if it makes incorrect statement on this subject, Bidder can be disqualified from the tender process or the contract, if already awarded, can be terminated for such reason

### **4. EARNEST MONEY (SECURITY DEPOSIT)**

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

### **5. SANCTIONS FOR VIOLATIONS**

- 5.1 Any breach of the aforesaid provisions by the Bidder/Contractor or any one employed by it or acting on its behalf shall entitle the Employer to take action as per the procedure mentioned in the "Guidelines on Banning of Business Dealings" attached as Annex-A and initiate all or any one of the following actions, wherever required:
- (i) To immediately disqualify the bidder and call off the pre contract negotiations without assigning any reason or giving any compensation to the Bidder/Contractor. However, the proceedings with the other Bidder(s)/Contractor(s) would continue.
  - (ii) The Earnest Money Deposit (in pre-contract stage) and/or Security Deposit/Performance Bond (after the contract is Signed) shall stand forfeited either fully or partially, as decided by the Employer and the Employer shall not be required to assign any reason thereof.
  - (iii) To immediately cancel the contract, if already signed, without giving any compensation to the Contractor. The Bidder/Contractor shall be liable to pay compensation for any loss or damage to the Employer resulting from such cancellation/rescission and the Employer shall be entitled to deduct the amount so payable from the money(s) due to the Bidder/Contractor.
  - (iv) To encash the Bank guarantee, in order to recover the dues if any by the Employer, along with interest as per the provision of contract.
  - (v) To debar the Bidder/Contractor from participating in future bidding processes of Employer, as per provisions of "Guidelines on Banning of Business Dealings" (**Annex-A**), which may be further extended at the discretion of the Employer.



- (vi) To recover all sums paid in violation of this Pact by Bidder(s)/Contractor(s) to any middleman or agent or broker with a view to securing the contract.
- (vii) In cases where irrevocable Letters of Credit have been received in respect of any contract signed by the Employer with the Bidder/ Contractor, the same shall not be opened/operated.
- (viii) Forfeiture of Performance Security in case of a decision by the Employer to forfeit the same without assigning any reason for imposing sanction for violation of this Pact.

5.2 The Employer will be entitled to take all or any of the actions mentioned at para 5.1 (i) to (viii) of this Pact also on the Commission by the Bidder/Contractor or any one employed by it or acting on its behalf (whether with or without the knowledge of the Bidder/Contractor), of an offence as defined in Chapter IX of the Indian Penal Code, 1860 or Prevention of Corruption Act, 1988 or any other statute enacted for prevention of corruption in Employer's country.

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

## **6. INDEPENDENT EXTERNAL MONITOR(S)**

6.1 The Employer has appointed Independent External Monitor(s) (hereinafter referred to as Monitors) for this Pact.

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

6.3 The Monitors shall not be subject to instructions by the representatives of the parties and perform their functions neutrally and independently.

6.4 Both the parties accept that the Monitors have the right to access all the documents relating to the project/procurement, for which a complaint or issue is raised before them, including minutes of meetings. The right to access records should only be limited to the extent absolutely necessary to investigate the issue related to the subject tender/contract.

6.5 As soon as the Monitor notices, or has reason to believe, a violation of this Pact, he will so inform CMD/CEO/MD of Employer and request Employer to discontinue or take corrective action, or to take other relevant action. The Monitor can in this regard submit non-binding recommendations. Beyond this the Monitor has no right to demand from the parties that they act in a specific manner, refrain from action or tolerate action.

6.6 The Bidder(s)/Contractor(s) accepts that the Monitor has the right to access without restriction, to all Project documentation of the Employer including that provided by the Bidder/Contractor. The Bidder/Contractor will also grant the Monitor, upon his request and demonstration of a valid interest, unrestricted and



unconditional access to his project documentation. The same is applicable to Subcontractor(s). The Monitor shall be under contractual obligation to treat the information and documents of the Bidder/Contractor/Subcontractor(s) with confidentiality.

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

6.8 The Monitor will submit a written report to the CMD/CEO/MD of Employer within 10 days from the date of reference or intimation to him by the Employer/Bidder and should the occasion arise, submit proposals for correcting problematic situations.

6.9 The word 'Monitor' would include both singular and plural

## **7. FACILITATION OF INVESTIGATION**

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

## **8. LAW AND PLACE OF JURISDICTION**

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

## **9. OTHER LEGAL ACTIONS**

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

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

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

## **10. VALIDITY**

10.1 The validity of this Integrity Pact shall be from date of its signing and extend upto 7 years or the complete execution of the contract to the satisfaction of both the Employer and the Bidder/Contractor/Seller, including warranty period, whichever is later. In case BIDDER is unsuccessful, this Integrity Pact shall expire after six months from the date of the signing of the contract or six months from



the date of opening of price bids, whichever is earlier.

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

**11.** The Parties hereby sign this Integrity Pact at \_\_\_\_\_ on \_\_\_\_\_.

Employer

Bidder

(Authorised Person)

(Name of Person)

(Name of Person)

(Designation)

(Designation)

Place:

Place:

Date:

Date:

Witness 1:

Witness 1:

Name & Address

Name & Address

Witness 2:

Witness 2:

Name & Address:

Name & Address:

### **GUIDELINES ON BANNING OF BUSINESS DEALINGS**

<b>S. No.</b>	<b>Description</b>
1.0	Introduction
2.0	Scope
3.0	Definitions
4.0	Initiation of Banning/Suspension
5.0	Suspension of Business Dealings
6.0	Ground on which Banning of Business dealing can be initiated
7.0	Banning of Business dealings
8.0	Removal from List of Approved agencies-Suppliers/Contractors etc.
9.0	Show-cause Notice
10.0	Appeal against the Decision of the Competent Authority.
11.0	Circulation of the names of Agencies with whom Business Dealings have been banned.



## **Guidelines on Banning of Business Dealings**

### **1. INTRODUCTION**

- 1.0 Employer deals with Agencies viz. parties/ contractors/ suppliers/ bidders, who are expected to adopt ethics of highest standards and a very high degree of integrity, commitments and sincerity towards the work undertaken. It is not in the interest of Employer to deal with Agencies who commit deception, fraud or other misconduct in the tendering process.
- 1.1 Since banning of business dealings involves civil consequences for an Agency concerned, it is incumbent that adequate opportunity of hearing is provided and the explanation, if tendered, is considered before passing any order in this regard keeping in view the facts and circumstances of the case.

### **2. SCOPE**

- 2.1 The Information for Bidders/ Instruction to Bidders and even the General Conditions of Contract (GCC) of Employer generally provide that Employer shall have the rights to remove from list of approved suppliers / contractors or to ban business dealings if any Agency has been found to have committed misconduct or fraud or anything unethical not expected from a reputed contractor.
- 2.2 The procedure of (i) Removal of Agency from the List of approved suppliers / contractors; (ii) Suspension and (iii) Banning of Business Dealing with Agencies, has been laid down in these guidelines.
- 2.3 These guidelines shall apply to all the Projects/ Power Stations/ Regional Offices/ Liaison Offices of MAHAPREIT including its subsidiaries and JVs.
- 2.4 It is clarified that these guidelines do not deal with the poor performance of the contractors/ Agencies.
- 2.5 The banning shall be with prospective effect, i.e., future business dealings.

### **3. DEFINITIONS**

- 3.1 In these Guidelines, unless the context otherwise requires:
- i) **"Party / Contractor / Supplier / Bidders"** shall mean and include a public limited company or a private limited company, a joint Venture, Consortium, HUF, a firm whether registered or not, an individual, cooperative society or an association or a group of persons engaged in any commerce, trade, industry, etc. "Party / Contractor/ Supplier / Bidder" in the context of these guidelines is indicated as 'Agency'.
- ii) **"Unit"** shall mean the Project/ Power Station/ Regional Office/ Liaison



Office.

- iii) **“Competent Authority”** and **‘Appellate Authority’** shall mean the following:

The concerned Director shall be the ‘Competent Authority’ for the purpose of these guidelines.

CMD shall be the ‘Appellate Authority’ in respect of such cases.

- iv) **“Investigating Committee”** shall mean any Officer/Committee appointed by Competent Authority to conduct investigation.
- v) **“List of approved Agencies viz Parties / Contractors / Suppliers/Bidders”** shall mean and include list of Parties/ Contractors / Suppliers / Bidders etc if registered with Employer.

#### **4. INITIATION OF BANNING / SUSPENSION**

Action for banning /suspension business dealings with any Agency shall be initiated by the department responsible for invitation of bids after noticing the irregularities or misconduct on the part of Agency concerned. Besides the concerned department, Vigilance Department of each Unit/ Corporate Vigilance may also be competent to initiate such action.

#### **5. SUSPENSION OF BUSINESS DEALINGS.**

- 5.1 If the conduct of any Agency dealing with Employer is under investigation, the Competent Authority may consider whether the allegations (under investigation) are of a serious nature and whether pending investigation, it would be advisable to continue business dealing with the Agency. If the Competent Authority, after consideration of the matter including the recommendation of the Investigating Committee, if any, decides that it would not be in the interest to continue business dealings pending investigation, it may suspend business dealings with the Agency. The order of suspension would operate for a period not more than six months and may be communicated to the Agency as also to the Investigating Committee. The Investigating Committee may ensure that their investigation is completed and whole process of final order is over within such period. However, if investigations are not completed in six months’ time, the Competent Authority may extend the period of suspension by another three months, during which period the investigations must be completed.
- 5.2 The order of suspension shall be communicated to all Departmental Heads of MAHAPREIT (including its subsidiaries and JVs) and Heads of the Units. During

- the period of suspension, no business dealing may be held with the Agency.
- 5.3 As far as possible, the existing contract(s) with the Agency may continue unless the Competent Authority, having regard to the circumstances of the case, decides otherwise.
  - 5.4 If the Agency concerned asks for detailed reasons of suspension, the Agency may be informed that its conduct is under investigation. It is not necessary to enter into correspondence or argument with the Agency at this stage.
  - 5.5 It is not necessary to give any show-cause notice or personal hearing to the Agency before issuing the order of suspension.

## **6. GROUND ON WHICH BANNING OF BUSINESS DEALINGS CAN BE INITIATED**

- 6.1 If the security consideration, including questions of loyalty of the Agency to Employer so warrants;
- 6.2 If the director /owner of the Agency, proprietor or partner of the firm, is convicted by a Court of Law for offences involving moral turpitude in relation to its business dealings with the Government or any other public sector enterprises, during the last three years.
- 6.3 If business dealings with the Agency have been banned by the Department of Power, Government of India and the relevant government department of Employer's Country.
- 6.4 If the Agency has resorted to corrupt, fraudulent practices including misrepresentation of facts;
- 6.5 If the Agency uses intimidation / threatening or brings undue outside pressure on Employer or its official for acceptance / performances of the job under the contract;
- 6.6 If the Agency misuses the premises or facilities of Employer, forcefully occupies or damages Employer's properties including land, water resources, forests / trees or tampers with documents/records etc. (Note: The examples given above are only illustrative and not exhaustive. The Competent Authority may decide to ban business dealing for any good and sufficient reason).

## **7. BANNING OF BUSINESS DEALINGS**

- 7.1 A decision to ban business dealings with any Agency shall apply throughout MAHAPREIT including its subsidiaries/JVs.
- 7.2 There will be an Investigating Committee consisting of officers not below the rank of GM/CGM and equivalent from Indenting Division, Finance, Law and Contracts. Member from department responsible for invitation of bids shall be the convener of the committee. The functions of the committee shall, inter-alia include:
  - i) To study the report of the unit/division responsible for invitation of bids and decide if a prima-facie case for banning exists, if not, send back the case to



the Competent Authority.

- ii) To recommend for issue of show-cause notice to the Agency by the concerned unit/division as per clause 9.1.
- iii) To examine the reply to show-cause notice and call the Agency for personal hearing, if required.
- iv) To submit final recommendations to the Competent Authority for banning or otherwise.

## **8. REMOVAL FROM LIST OF APPROVED AGENCIES - SUPPLIERS/ CONTRACTORS, ETC.**

- 8.1 If the Competent Authority decides that the charge against the Agency is of a minor nature, it may issue a show-cause notice as to why the name of the Agency should not be removed from the list of approved Agencies - Suppliers / Contractors, etc.
- 8.2 The effect of such an order would be that the Agency would not be qualified for competing in Open Tender Enquiries or Limited Tender Enquiries till the period mentioned in the order.
- 8.3 Past performance of the Agency may be taken into account while processing approval of the Competent Authority for award of the contract.

## **9. SHOW-CAUSE NOTICE**

- 9.1 In case where the Competent Authority decides that action against an Agency is called for, a show-cause notice has to be issued to the Agency, Statement containing the imputation of misconduct or misbehavior may be appended to the show-cause notice and the Agency should be asked to submit within 15 days a written statement in its defense.
- 9.2 If the Agency requests for inspection of any relevant document in possession of Employer, necessary facility for inspection of documents may be provided.
- 9.3 The Competent Authority may consider and pass an appropriate speaking order:
  - a) For exonerating the Agency if the charges are not established;
  - b) For removing the Agency from the list of approved Suppliers / Contractors, etc.
  - c) For banning the business dealing with the Agency.





- 9.4 If it decides to ban business dealings, the period for which the ban would be operative may be mentioned.

#### **10. APPEAL AGAINST THE DECISION OF THE COMPETENT AUTHORITY**

- 9.5 The Agency may file an appeal against the order of the Competent Authority banning business dealing etc. The appeal shall be filed to Appellate Authority. Such an appeal shall be preferred within one month from the date of receipt of the order banning business dealing, etc.
- 9.6 Appellate Authority would consider the appeal and pass appropriate order which shall be communicated to the Agency as well as the Competent Authority.

#### **11. CIRCULATION OF THE NAMES OF AGENCIES WITH WHOM BUSINESS DEALINGS HAVE BEEN BANNED**

- i) The concerned unit shall forward the name and details of the Agency(ies) banned to IT&C Division of MAHAPREIT's Corporate Office for displaying the same on MAHAPREIT website.
- ii) Corporate Contracts Department shall also forward the name and details of the Agency(ies) banned to the Ministry of Power, GoI besides forwarding the name and details to the con- tracts/procurement group of all CPSUs of power sector.



## **FORM OF DECLARATION OF ELIGIBILITY**

### **UNDERTAKING**

I / We, M/s.....(Name of Bidder) hereby certify that I / we have not been banned /de-listed/ black listed / debarred from business by any PSU / Govt. Department during last 03 (three) years on the grounds mentioned in para 6 of Guidelines on banning of Business dealing, ITB Clause of Tender Document.

**(Seal & signature of the Bidder)**



**PROFORMA FOR BLACK LISTING**

**UNDERTAKING**

To

Chief General Manager (SEP) (Designation)

Mahatma Phule Renewable Energy & Infrastructure Technology Limited.

B-501 Pinnacle Corporate Park, Next to Trade Center,

BKC, Bandra (East), Mumbai – 400051

**Subject:** Design, Engineering, Supply, Construction, Erection, Testing, Commissioning, and five (05) years comprehensive Operation & Maintenance of 50 MW(AC) grid connected solar PV power plant in the state of Maharashtra.

Dear Sir,

I / We, M/ s..... (Name of Bidder) hereby certify that I / we have not been banned / de-listed / black listed / debarred from business by any PSU / Govt. Department during last 03 (three) years. I/We will immediately inform to Client (MAHAPREIT Limited) in case of any change in the situation any time hereinafter.

Yours sincerely,

Authorized Signature [*In full and initials*]:

Name and Title of Signatory:

Name of the Bidder:

Address:

Seal of the Bidder: \_\_\_\_\_



## ATTACHMENT 6

### NO DEVIATION CERTIFICATE

To  
Chief General Manager (SEP) (Designation)  
Mahatma Phule Renewable Energy & Infrastructure Technology Limited.  
B-501 Pinnacle Corporate Park, Next to Trade Center,  
BKC, Bandra (East), Mumbai – 400051

**Subject:** No Deviation Certificate regarding Design, Engineering, Supply, Construction, Erection, Testing, Commissioning, and five (05) years comprehensive Operation & Maintenance of 50 MW(AC) grid connected solar PV power plant in the state of Maharashtra.

Dear Sir,

We, [Bidder's name], confirm our acceptance to all terms and conditions mentioned in the Bid Document Ref No \_\_\_\_\_ including all subsequent clarifications/ amendment/addendum/corrigendum(s), in totality and withdraw all deviations raised by us, if any.

Yours sincerely,

Authorized Signature [*In full and initials*]:

Name and Title of Signatory:

Name of the Bidder:

Address:

Seal of the Bidder: \_\_\_\_\_



**PROFORMA FOR ELECTRONIC FUND TRANSFER (EFT)**

To  
Chief General Manager (SEP) (Designation)  
Mahatma Phule Renewable Energy & Infrastructure Technology Limited.  
B-501 Pinnacle Corporate Park, Next to Trade Center,  
BKC, Bandra (East), Mumbai – 400051

**Ref:** Authorization for payments through Electronic Fund Transfer System.

Dear Sir,

We, hereby authorize MAHAPREIT (Complete address of the Unit with Postal Code) to make all payments due to us through Electronic Fund Transfer System. The details for facilitating the payments are given below:

(TO BE FILLED IN CAPITAL LETTER)

1. NAME OF THE BENEFICIARY

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

2. ADDRESS


3. TELEPHONE NO (WITH STD CODE)

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

4. FAX NO. (WITH STD CODE)

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

5. BANK PARTICULARS:

A) BANK NAME

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--





6. PERMANENT ACCOUNT NUMBER (PAN)

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

7. E-MAIL ADDRESS FOR INTIMATION REGARDING RELEASE OF PAYMENTS

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

It is certified that the particulars given above are correct and complete. If the transaction is delayed or credit is not effected at all for reasons of incomplete or incorrect information, I/ we would not hold the Company responsible.

SIGNATURE

Date:

--	--	--	--	--	--	--	--

(AUTHORISED SIGNATORY)

NAME:


OFFICIAL STAMP

BANK CERTIFICATION

It is certified that above mentioned beneficiary hold a Bank Account No with our branch and the Bank particulars mentioned above are correct.

SIGNATURE

Date:

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(AUTHORISED SIGNATORY OF THE BANK)

Authorization No.....



NAME:


OFFICIAL STAMP

Seal of the Bidder: \_\_\_\_\_

Place:

Date:





**TECHNICAL DATA OF THE BIDDER**

To  
Chief General Manager (SEP) (Designation)  
Mahatma Phule Renewable Energy & Infrastructure Technology Limited.  
B-501 Pinnacle Corporate Park, Next to Trade Center,  
BKC, Bandra (East), Mumbai – 400051

**Subject:** Design, Engineering, Supply, Construction, Erection, Testing, Commissioning, and five (05) years comprehensive Operation & Maintenance of 50 MW(AC) grid connected solar PV power plant in the state of Maharashtra.

Dear Sir,

A. The bidder shall submit the details as under:

- i. Total capacity (in MW) for which bid submitted  
:.....
- ii. Capacity for which bidder has quoted prices in the price bid (electronic form)

B. In support of Qualifying Requirements of Clause 1.4.1.1 of Bid Document, we confirm that we have designed, supplied, erected/ supervised erection and commissioned/ supervised commissioning of Balance of System/EPC of Solar PhotoVoltaic (SPV) based grid connected power plant(s) of cumulative installed capacity of 25 MWp or higher capacity in the last seven (7) years prior to date of NIT, out of which at least one plant of 20 MWp or higher capacity. The reference plant of 20 MWp or higher capacity must have been in successful operation for at least three (3) months prior to the date of NIT.

Details of plant(s) are as under:

Sl. No.	Item Description	Reference Plant 1(20 MWp or above)	Reference Plant 2	Reference Plant 3 ...	Cumulative
1.	Description of work				
2.	Name of Client with full address, FaxNo. & Tel. No.				
3.	Name of the Power plant with its location				

4.	Name and designation of the responsible person in the organization				
5.	Contract No. and Date				
6.	Whether this is a SPV based grid connected Power Plant	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>
7.	Capacity of the Plant	MWp	MWp	MWp	MWp
8.	Whether scope of works included				
	(a) Design	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>
	(b) supply	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>
	(c) erection	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>
	(d) supervised erection	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>
	(e) commissioning	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>
	(f) supervised commissioning System/EPC	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>

	(b) Operation and maintenance				
9.	Date of Commissioning of the above Plant				
10.	Date of Start of Operation and Maintenance of above plant				

*\*Strike off whichever is not applicable*

**Note:**

- 1. Bidder shall submit documentary evidence i.e. Copies of authentic purchase orders/LOA, Agreements, Certificate from Clients in support of details/data of Sl. No. 1 to 10 above,.*
- 2. Continuation sheets of like size and format may be used and annexed to this Attachment if required.*

D1. In support of Qualifying Requirements of Clause 1.4.1 of Bid Document, we confirm that we are developer of Solar Photo Voltaic (SPV) based grid connected powerplant(s) of cumulative installed capacity of 25 MWp or higher capacity in the last seven (7) years prior to date of NIT, out of which at least one such plant of 20 MWp or higher capacity. The reference plant(s) of 20 MWp or higher capacity must have been in successful operation for at least three (3) months prior to the date of NIT.

<b>Sl. No.</b>	<b>Item Description</b>	<b>Reference Plant 1(20 MWp or above)</b>	<b>Reference Plant 2</b>	<b>Reference Plant3 ...</b>	<b>Cumulative</b>
1.	Description of work				
2.	Name of Client with full address, FaxNo. & Tel. No.				
3.	Name of the Power plant with its location				
4.	Name and designation of the responsible person				

	in the organization				
5.	Contract No. and Date				
6.	Whether this is a SPV based grid connected Power Plant	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>
7.	Capacity of the Plant	MWp	MWp	MWp	MWp
8.	Whether scope of works included				
	(g) Design	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>
	(h) supply	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>
	(i) erection	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>
	(j) supervised erection	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>
	(k) commissioning	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>
	(l) supervised commissioning System/EPC	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>
	(b) Operation and maintenance	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>

9.	Date of Commissioning of the above Plant				
10.	Date of Start of Operation and Maintenance of above plant				

*\*Strike off whichever is not applicable*

**Note:**

1. Bidder shall submit documentary evidence i.e., Copies of authentic purchase orders/LOA, Agreements, Certificate from Clients in support of details/data of Sl. No. 1 to 10 above,
2. Continuation sheets of like size and format may be used and annexed to this Attachment if required.

C. In support of Qualifying Requirements of Clause 1.4.1 of Bid Document, we confirm that we have executed in the last seven (7) years prior to the date of NIT, an industrial project either as developer or as EPC Contractor in the area of power/ steel/ oil and gas/ Petro-chemical/ fertilizer/cement/coal mining including coal handling plant and/ or any other process industry in a single project or single work and the same should be in successful operation for at least three (03) months prior to the date of NIT.

Details of works are as under:

Sl. No.	Item Description	Reference Project
1.	Description of work	
2.	Name of Client with full address, Fax No. & Tel. No.	
3.	Name of the industrial project with its location	
4.	Name and designation of the responsible person in client's organization	
5.	Contract No. and Date	
6.	Cost of the project (in crore) in a single project work	

7.	The Industrial Project is in the area of (a) Power (b) Steel (c) Oil and Gas (d) Petro-Chemical (e) Fertilizer (f) Cement (g) Coal Mining including coal handling plant (h) Any other process industry	YES* <input type="checkbox"/> / NO* <input type="checkbox"/> YES* <input type="checkbox"/> / NO* <input type="checkbox"/> YES* <input type="checkbox"/> / NO* <input type="checkbox"/> YES* <input type="checkbox"/> / NO* <input type="checkbox"/> YES* <input type="checkbox"/> / NO* <input type="checkbox"/> YES* <input type="checkbox"/> / NO* <input type="checkbox"/> YES* <input type="checkbox"/> / NO* <input type="checkbox"/> YES* <input type="checkbox"/> / NO* <input type="checkbox"/>
8.	Whether the Industrial Project has beenexecuted as: (a) Developer (b) EPC Contractor	YES* <input type="checkbox"/> / NO* <input type="checkbox"/> YES* <input type="checkbox"/> / NO* <input type="checkbox"/>
9.	Date of Commissioning of the above Projector work	
10.	Date of Start of Operation and maintenanceof above project	

*\*Strike off whichever is not applicable*

**Note:**

- 1. Bidder shall submit documentary evidence i.e., Copies of authentic purchase orders/LOA,Agreements, Certificate from Clients in support of details/data of Sl. No. 1 to 10 above.*
- 2. Continuation sheets of like size and format may be used and annexed to this Attachment if required*

D2. In support of Qualifying Requirements of Clause 1.4 of Bid Document, we confirm that we have executed at least one (1) Electrical Sub-station of 33 kV or abovevoltage level, consisting of equipment such as 33kV or above voltage level circuit breakers and Power transformer, either as developer or as EPC Contractor which shouldbe in successful operation for at least three (03) months prior to the date of NIT

Sl. No.	Item Description	Reference Project
1.	Description of work	

2.	Name of Client with full address, Fax No. & Tel. No.	
3.	Name of the Sub-Station with its location	
4.	Name and designation of the responsible person in client's organization	
5.	Contract No. and Date	
6.	Voltage level of Electrical Substation	
7.	Electrical Sub Station consisting of equipments of 33 KV or above: (a) Circuit Breaker (b) Power Transformers	YES* <input type="checkbox"/> / NO* <input type="checkbox"/> YES* <input type="checkbox"/> / NO* <input type="checkbox"/>
8.	Whether the Electrical Sub Station has been executed as: (a) Developer (b) EPC Contractor	YES* <input type="checkbox"/> / NO* <input type="checkbox"/> YES* <input type="checkbox"/> / NO* <input type="checkbox"/>
9.	Date of Commissioning of the Sub-Station	
10.	Date of Start of Operation of the above sub-station	

\*Strike off whichever is not applicable

**Note:**

1. Bidder shall submit documentary evidence i.e. Copies of authentic purchase orders/LOA, Agreements, Certificate from Clients in support of details/data of Sl. No. 1 to 10 above.
2. Bidder may furnish additional reference plant which have been in operation for at least three (03) months prior to the date of NIT.
3. Continuation sheets of like size and format may be used and annexed to this Attachment if required

E. In support of Qualifying Requirements of Clause 1.4 of Bid Document, we .....(name of bidder) confirm that we are an Indian company registered in India and should be Group company/Holding Company/Subsidiary company of a firm meeting the requirement (s) of Clause 1.4 above. In such a case, we shall furnish an Undertaking jointly executed by the firm .....(name of firm) who meets the requirement of clause 1.4



In support of same, we submit the following documents (as per format enclosed in the bid document), failing which the Bidder's bid is liable to be rejected.

- Certificate of incorporation of M/s .....(name of bidder) shall be provided in **Appendix-1 to Attachment-8.**
- Please provide the details of Group company/ Holding company/ subsidiary company as per **Appendix-2 of Attachment-8.** Also provide documents to establish M/s (Name of the bidder) is the Group company/ holding company/ subsidiary company of the firm ..... (name of the firm).
- We have enclose an undertaking jointly executed by the firm M/s ..... who meets the requirement of clause 1.4 and us along with its bid for complete performance of the contract jointly or severally as per format enclosed in **Appendix- 3 of Attachment -8.**
- As per requirement, the firm has to meet the clause 1.4 The experiencedetails of the firm as per the format (E1 or E2or E3) is as under:

E1. In support of Qualifying Requirements of Clause 1.4 of Bid Document, we confirm that M/s..... have designed, supplied, erected/ supervised erection and commissioned/ supervised commissioning of Balance of System/EPC of Solar Photo Voltaic (SPV) based grid connected power plant(s) of cumulative installed capacity of 25 MWp or higher capacity in the last seven (7) years prior to date of NIT, out of which at least one plant of 20 MWp or higher capacity. The reference plant of 20 MWp or higher capacity must have been in successful operation for at least three (3) months prior to the date of NIT

Details of plant are as under:

Sl. No.	Item Description	Reference Plant 1(20 MWp or above)	Reference Plant 2	Reference Plant3 ...	Cumulative
1.	Description of work				
2.	Name of Client with full address, FaxNo. & Tel. No.				
3.	Name of the Power plant with its location				



Sl. No.	Item Description	Reference Plant 1(25 MWp or above)	Reference Plant 2	Reference Plant3 ...	Cumulative
4.	Name and designation of the responsible person in the organization				
5.	Contract No. and Date				
6.	Whether this is a SPV based grid connected Power Plant	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>
7.	Capacity of the Plant	MWp	MWp	MWp	MWp
8.	Whether scope of works included				
	(m) Design	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>
	(n) supply	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>
	(o) erection	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>
	(p) supervised erection	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>
	(q) commissioning	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>
	(r) supervised commissioning	<input type="checkbox"/> YES* <input type="checkbox"/> / NO* <input type="checkbox"/>	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>

Sl. No.	Item Description	Reference Plant 1 (20 MWp or above)	Reference Plant 2	Reference Plant 3 ...	Cumulative
	System/EPC  (b) Operation and maintenance		YES* <input type="checkbox"/> / NO*	YES* <input type="checkbox"/> / NO*	YES* <input type="checkbox"/> / NO*
9.	Date of Commissioning of the above Plant				
10.	Date of Start of Operation and Maintenance of above plant				

\*Strike off whichever is not applicable

Note:

1. Bidder shall submit documentary evidence i.e. Copies of authentic purchase orders/LOA, Agreements, Certificate from Clients in support of details/data of Sl. No. 1 to 10 above.
2. Continuation sheets of like size and format may be used and annexed to this Attachment if required

E2. In support of Qualifying Requirements of Clause 1.4 of Bid Document, we confirm that M/s ..... are developer of Solar Photo Voltaic (SPV) based grid connected power plant(s) of cumulative installed capacity of 100 MWp or higher capacity in the last seven (7) years prior to date of NIT, out of which at least one such plant of 25 MWp or higher capacity. The reference plant(s) of 25 MWp or higher capacity must have been in successful operation for at least three (3) months prior to the date of NIT.

Details of plant(s) are as under:

Sl. No.	Item Description	Reference Plant 1 (25 MWp or above)	Reference Plant 2	Reference Plant 3 ...	Cumulative
1.	Description of work				

2.	Name of Client with full address, FaxNo. & Tel. No.				
3.	Name of the Power plant with its location				
4.	Name and designation of the responsible person in the organization				
5.	Contract No. and Date				
6.	Whether this is a SPV based grid connected Power Plant	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>
7.	Capacity of the Plant	MWp	MWp	MWp	MWp
8.	Whether scope of works included				
	(s) Design	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>
	(t) supply	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>
	(u) erection	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>
	(v) supervised erection	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>
	(w) commissioning	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>	YES* <input type="checkbox"/> / NO* <input type="checkbox"/>

	(x) supervised commissioning System/EPC	YES* <input type="checkbox"/> / NO*	YES* <input type="checkbox"/> / NO*	NO* <input type="checkbox"/> YES* <input type="checkbox"/> / NO*	NO* <input type="checkbox"/> YES* <input type="checkbox"/> / NO*
	(b) Operation and maintenance				
9.	Date of Commissioning of the above Plant				
10.	Date of Start of Operation and Maintenance of above plant				

\*Strike off whichever is not applicable

Note:

3. Bidder shall submit documentary evidence i.e. Copies of authentic purchase orders/LOA, Agreements, Certificate from Clients in support of details/data of Sl. No. 1 to 10 above.
4. Continuation sheets of like size and format may be used and annexed to this Attachment if required

E3. In support of Qualifying Requirements of Clause 1.4 of Bid Document, we confirm that M/s have executed in the last seven (7) years prior to the date of NIT, an industrial project either as developer or as EPC Contractor in the area of power/ steel/ oil and gas/ Petro- chemical/ fertilizer/cement/coal mining including coal handling plant and/ or any other process industry, of a value of Rs. 2 Crore/MW in a single project or single work and the same should be in successful operation for at least six (6) months prior to the date of NIT.

Details of works are as under:

Sl. No.	Item Description	Reference Project
1.	Description of work	
2.	Name of Client with full address, Fax No. & Tel. No.	
3.	Name of the industrial project with its location	
4.	Name and designation of the responsible person in client's	

	organization	
5.	Contract No. and Date	
6.	Cost of the project (in crore) in a single project work	
7.	The Industrial Project is in the area of (i) Power (j) Steel (k) Oil and Gas (l) Petro-Chemical (m) Fertilizer (n) Cement (o) Coal Mining including coal handling plant (p) Any other process industry	YES* <input type="checkbox"/> / NO* <input type="checkbox"/> YES* <input type="checkbox"/> / NO* <input type="checkbox"/> YES* <input type="checkbox"/> / NO* <input type="checkbox"/> YES* <input type="checkbox"/> / NO* <input type="checkbox"/> YES* <input type="checkbox"/> / NO* <input type="checkbox"/> YES* <input type="checkbox"/> / NO* <input type="checkbox"/> YES* <input type="checkbox"/> / NO* <input type="checkbox"/> YES* <input type="checkbox"/> / NO* <input type="checkbox"/>
8.	Whether the Industrial Project has been executed as: (c) Developer (d) EPC Contractor	YES* <input type="checkbox"/> / NO* <input type="checkbox"/> YES* <input type="checkbox"/> / NO* <input type="checkbox"/>
9.	Date of Commissioning of the above Projector work	
10.	Date of Start of Operation and maintenance of above project	

*\*Strike off whichever is not applicable*

**Note:**

- 1. Bidder shall submit documentary evidence i.e., Copies of authentic purchase orders/LOA, Agreements, Certificate from Clients in support of details/data of Sl. No. 1 to 10 above.*
- 2. Continuation sheets of like size and format may be used and annexed to this Attachment if required*

E4. In support of Qualifying Requirements of Clause 1.4 of Bid Document, we confirm that we have executed at least one (1) Electrical Sub-station of 33 kV or above voltage level, consisting of equipment such as 33kV or above voltage level circuit breakers and Power transformer, either as developer or as EPC Contractor which should be in successful operation for at least three (03) months prior to the date of NIT

Sl. No.	Item Description	Reference Project
1.	Description of work	
2.	Name of Client with full address, Fax No. & Tel. No.	
3.	Name of the Sub-Station with its location	
4.	Name and designation of the responsible person in client's organization	
5.	Contract No. and Date	
6.	Voltage level of Electrical Substation	
7.	Electrical Sub Station consisting of equipments of 33 KV or above: (c) Circuit Breaker (d) Power Transformers	YES* <input type="checkbox"/> / NO* <input type="checkbox"/> YES* <input type="checkbox"/> / NO* <input type="checkbox"/>
8.	Whether the Electrical Sub Station has been executed as: (c) Developer (d) EPC Contractor	YES* <input type="checkbox"/> / NO* <input type="checkbox"/> YES* <input type="checkbox"/> / NO* <input type="checkbox"/>
9.	Date of Commissioning of the Sub-Station	
10.	Date of Start of Operation of the above sub-station	

\*Strike off whichever is not applicable

**Note:**

1. Bidder shall submit documentary evidence i.e. Copies of authentic purchase orders/LOA, Agreements, Certificate from Clients in support of details/data of Sl. No. 1 to 10 above.
2. Bidder may furnish additional reference plant which have been in operation for at least three (03) months prior to the date of NIT.
3. Continuation sheets of like size and format may be used and annexed to this Attachment if required



## **Appendix 1 to Attachment 8**

Bidder shall enclose Certificate of Incorporation along with the Bid



## Appendix 2 to Attachment 8

### DETAILS OF THE FIRM

The details of Group company/ Holding company/ subsidiary company of the Bidder is as under:

Sl No.	Description of the Group company/ Holding company/ Subsidiary company of the Bidder	Information
1.	Name of the company	
2.	Please specify whether, Group company/Holding company/ Subsidiary company	
3.	Full Address of the company	
4.	Telephone No.	





## Appendix 2 to Attachment 8

### FORM OF UNDERTAKING BY BIDDER AND THE FIRM

**Joint undertaking between Indian bidder and the firm (who qualify under requirements of clause 1.4.1.1 or 1.4.1.2 or 1.4.1.3), for Design, Engineering, Supply, Construction, Erection, Testing, Commissioning, and five (05) years comprehensive Operation & Maintenance of 50 MW(AC) grid connected Solar PV power plant in the state of Maharashtra, in which the firm and the bidder are jointly and severally liable to the Employer for the complete performance of contract in case of award.**

We, M/s ..... a Company incorporated under the ..... having its Registered Office at ..... (The Firm) and M/s a company incorporated under the ..... having its registered office at ..... (The Bidder) jointly undertake the following on ..... day of ..... for the ..... to Mahatma Phule Renewable Energy & Infrastructure Technology Limited, company incorporated under the Companies Act, 2013, having its Registered Office at Corporate Headquarter, B-501 Pinnacle Corporate Park, Next to Trade Center, BKC, Bandra (East), Mumbai – 400051 (M.H.).

Mahatma Phule Renewable Energy & Infrastructure Technology Limited (Employer) has invited bids for ...vide its Bid Document No. ....for **(Name of Bidder)** M/s. .... (Bidder) is submitting its proposal in response to the aforesaid Bidding Document No. ...for development of grid connected Solar PV project(s) of capacity against the bid document no.....

1. In case of the Award of the Contract by the Employer to the Bidder, we the Bidder and the Firm undertake that we shall be jointly and severally responsible to the Employer for the complete performance of Contract.
2. In case of any breach of the Contract (in case of award) committed by the Bidder, we the Firm undertake and confirm that we shall be fully responsible for the complete performance of Contract (in case of award) and undertake to carry out all the obligations and responsibilities under this joint Undertaking in order to discharge the Bidder's obligation and responsibilities as stipulated in the contract.
3. The Bidder and the Firm will be fully responsible for the quality of all the equipment manufactured at their works or at their vendor works or construction at site, and their repair or replacement, if necessary and timely delivery to meet the completion schedule under the Contract (in case of award).
4. We, the Bidder the Firm agree that this undertaking shall be irrevocable and



shall form an integral part of the Contract. We further agree that this undertaking shall continue to be enforceable till the successful completion of Contract and till the Employer discharge it.

5. The Joint Undertaking shall be operative from the effective date of the Contract until ninety (90) days beyond the Defect Liability Period.

For M/s .....

(The Firm)

(Signature of the authorized representative)

Name .....

Designation .....

Common Seal of the Company

For M/s .....

(The Employer)

(Signature of the authorized representative)

Name .....

Designation .....

Common Seal of the Company

.....

**Note: Power of Attorney of the Persons Signing on behalf of the Firm and Bidder is to be furnished by the Bidder and to be attached with this signed Joint Undertaking.**



**FINANCIAL DATA OF THE BIDDER**

To  
Chief General Manager (SEP) (Designation)  
Mahatma Phule Renewable Energy & Infrastructure Technology Limited.  
B-501 Pinnacle Corporate Park, Next to Trade Center,  
BKC, Bandra (East), Mumbai – 400051

**Subject:** Design, Engineering, Supply, Construction, Erection, Testing, Commissioning, and five (05) years comprehensive Operation & Maintenance of 50 MW(AC) grid connected solar PV power plant in the state of Maharashtra.

**(Financial Data pertaining to Financial Qualification of the Bidder as per Clause 1.4.2 of NIT)**

Bidder’s Name & Address	Chief General Manager (SEP) (Designation) Mahatma Phule Renewable Energy & Infrastructure Technology Limited. B-501 Pinnacle Corporate Park, Next to Trade Center, BKC, Bandra (East), Mumbai – 400051
-------------------------	--

Dear Sirs,

A. In support of Qualifying Requirements of Clause 1.4 of Bid Document, we confirm that our average annual turnover for preceding three (3) financial years as on date of NIT is not less than\_\_\_\_\_.In support of above, we are enclosing Audited Financial Statements. The detail of our annual turnover for the preceding three (3) financial years are as under:

Sl. NO.	Financial Year	Amount in Rupees (in Lakh)
1.	2021-22	
2.	2020-21	
3.	2019-20	
4.	Average Annual Turnover for the above three (3) Financial Years	INR .....

**Note:**



1. Bidder shall submit Audited Financial Statements and certificate from the Statutory Auditor / Chartered Accountant for preceding three (3) Financial Years as on date of NIT.
2. In case where audited results for the last financial year as on the date of NIT are not available, certification of financial results certified by practicing chartered accountant shall also be considered acceptable.
3. For the purposes of meeting financial requirements, only unconsolidated audited annual accounts shall be used. However, audited consolidated annual accounts of the Bidder may be used for the purpose of financial requirements provided the Bidder has at least twenty six percent (26%) equity in each company whose accounts are merged in the audited consolidated accounts

**B. For bidders not meeting the requirement of Clause 1.4.2.1 of NIT on its own**

Since we do not satisfy the Financial Criteria stipulated at Clause 1.4.2.1 of NIT, On its Own, we give below the following details of our Holding Company In terms of Clause 1.4.2.1 of NIT who meet the stipulated turnover requirements and whose Net worth as on the last day of the preceding financial year is at least equal to or more than the paid-up share capital of the Holding Company.

1. Name and Address of the Holding Company: .....
2. Annual Turnover of the Holding Company with following details:

Sl. NO.	Financial Year	Amount in Rupees (in Lakh)
1.	2021-22	
2.	2020-21	
3.	2019-20	
4.	Average Annual Turnover for the above three (3) Financial Years	INR .....

*\*Please Strike off whichever is not applicable.*

**Note:**

1. Bidder shall submit Audited Financial Statements and certificate from the Statutory Auditor / Chartered Accountant for preceding three (3) Financial Years of the Holding Company as on date of NIT.
2. Bidder shall also submit a Letter of Undertaking from the Holding Company, supported by the Holding Company's Board Resolution, as per the format enclosed in **Appendix 1 to Attachment 9** of the bid documents, pledging unconditional and irrevocable financial support for the execution of the Contract by the Bidder in case of award.

Place

Name

Date

Designation

C. In support of Qualifying Requirements of Clause 1.4 of Bid Document, we hereby confirm that networth of our company is as under:

Sl. No.	Financial Year	Amount in Rupees (in Lakh)	Positive/Negative
1.	2021-22		
2.	2020-21		
3.	2019-20		

Note:

1. Documentary evidence like Annual Report/ Audited financial statements for the preceding three (03) Financial years/ in case Audited results for the preceding Financial Year is not available, certification of financial statements from a practicing Chartered Accountant etc. in support of above.
2. For the purposes of meeting financial requirements, only unconsolidated audited annual accounts shall be used. However, audited consolidated annual accounts of the Bidder may be used for the purpose of financial requirements provided the Bidder has at least twenty six percent (26%) equity in each company whose accounts are merged in the audited consolidated accounts

D. In support of Qualifying Requirements of Clause 1.4.2.3 of Bid Document, we hereby confirm that working capital for last financial year of our company is as under:

Sl. No.	Financial Year	Amount in Rupees (in Lakh)
1.	Current Assets (CA)	
2.	Current Liabilities (CL)	
3.	Working Capital (CA-CL)	

**Note:** Bidder shall also submit banking reference from Scheduled Bank in India in support of working capital and it should not be more than 03 months old as on the last date of submission of bid. Above Banking reference(s) should contain in clear terms the amount that the Bank will be in a position to lend for this work to the bidder. In case the Net Working Capital (as seen from the Balance Sheet) is negative, only the Banking reference(s) will be considered, otherwise the aggregate of the Net



Working Capital and submitted Banking reference(s) will be considered for working out the working capital. The banking reference, if any shall be attached as Appendix-2 to Attachment-9.

*Place*

*Name*

*Date*

*Designation*



**Appendix 1 to Attachment 9**

**(To be executed on Letterhead of the Holding Company)**

To  
Chief General Manager (SEP) (Designation)  
Mahatma Phule Renewable Energy & Infrastructure Technology Limited.  
B-501 Pinnacle Corporate Park, Next to Trade Center,  
BKC, Bandra (East), Mumbai – 400051

Dear Sir(s)

1. We, M/s..... [Insert name of Holding Company] declare that we are the holding company of M/s ..... [Insert name of Bidder] and have controlling interest therein. M/s. .... [Insert name of Bidder] ..... proposes to submit the Bid for Package..... [Insert name of the package] having reference no.....and have sought financial strength and support from us for meeting the stipulated Financial Qualifying Requirement as per Clause No. 1.3 [Eligibility Criteria].
2. We hereby undertake that we hereby pledge our unconditional & irrevocable financial support for the execution of the contract for ..... to M/s. .... [Insert name of Bidder] in case of award. We further agree that this undertaking shall be without prejudice to the all-contractual liabilities that M/s ..... [Insert name of Bidder] ..... would be required to undertake in terms of the Contract including the CPSG as well as other obligations of the Bidder/Contractor.
3. This undertaking is irrevocable and unconditional, and shall remain in force till completion of the Contract.
4. We are herewith enclosing a copy of the Board Resolution in support of this Undertaking.

Place

Authorized Signature [*In full and initials*]:

Date

Name and Title of Signatory:

Name of the Bidder:

Address:

Seal of the Bidder:\_\_\_\_\_



## **Appendix 1 to Attachment 9**

(Bidder shall submit banking reference, if any in support of Working capital in this attachment)





**ATTACHMENT 10**

**FORMAT FOR DECLARED NET ANNUAL GUARANTEED GENERATION (NAGG)  
FOR THE PROPOSED SOLAR PV POWER PLANT**

To  
Chief General Manager (SEP) (Designation)  
Mahatma Phule Renewable Energy & Infrastructure Technology Limited.  
B-501 Pinnacle Corporate Park, Next to Trade Center,  
BKC, Bandra (East), Mumbai – 400051

**Dear Sir(s)**

We hereby confirm the proposed Net Annual Guaranteed Generation at identified project locations as here under:

<b>Project Location</b>	<b>Proposed Net Annual Guaranteed Generation (NAGG)</b>
KUNDALPUR	
TISANGI	
RAJURI	
GHATNANDRE	

**NOTE:** - Bidders to submit the documentary proof for arriving at the Declared Net Annual Guaranteed Generation (NAGG) such as Energy Estimation Report using the latest software such as PV Syst, Meteonorm.

Place

Authorized Signature [*In full and initials*]:

Date

Name and Title of Signatory:

Name of the Bidder:

Address:

Seal of the Bidder:\_\_\_\_\_



## Appendix A to Attachment 10

To  
Chief General Manager (SEP) (Designation)  
Mahatma Phule Renewable Energy & Infrastructure Technology Limited.  
B-501 Pinnacle Corporate Park, Next to Trade Center,  
BKC, Bandra (East), Mumbai – 400051

### **Minimum Net Annual Guaranteed Generation (NAGG) to be achieved every year by the Contractor.**

S. No.	Year	Minimum Net Annual Guaranteed Generation (NAGG) to be generated each year (in MU) *
1.	1 <sup>st</sup> Year of O&M (For 50 MW)	_____

*\*Strike off whichever is not applicable.*

*\*Degradation (MCF) for 3 years shall be as 0.7% every year.*

**Note:** This is the minimum number of units, which needs to be generated by the Contractor every year. The Contractor, however, shall quote the actual number of unit generation as per the **Attachment 10**. The Bids containing the less generation as indicated in this annexure shall be rejected



## ATTACHMENT 11

### FORMAT FOR SUBMISSION OF TIME SCHEDULE

To  
Chief General Manager (SEP) (Designation)  
Mahatma Phule Renewable Energy & Infrastructure Technology Limited.  
B-501 Pinnacle Corporate Park, Next to Trade Center,  
BKC, Bandra (East), Mumbai – 400051

**Subject:** Design, Engineering, Supply, Construction, Erection, Testing, Commissioning, and five (05) years comprehensive Operation & Maintenance of 50 MW(AC) grid connected solar PV power plant in the state of Maharashtra.

We hereby confirm the acceptance to the time schedule (... ) month for completion of Facilities) as specified in the Clause No. 3.17 of the Bid Document. Further, we are submitting the detailed activity wise Time schedule (L1 Schedule) in the form of PERT Chart covering all aspects like ordering, site preparation, Supply, erection, installation, testing & commissioning, etc. for each unit along with the bid.

Place	Authorized Signature [ <i>In full and initials</i> ]:
Date	Name and Title of Signatory:
	Name of the Bidder:
	Address:
	Seal of the Bidder:_____



## ATTACHMENT 12

### FORMAT FOR LIST OF SUB-CONTRACTORS /VENDORS PROPOSED TO BE ENGAGED

To

Chief General Manager (SEP) (Designation)  
Mahatma Phule Renewable Energy & Infrastructure Technology Limited.  
B-501 Pinnacle Corporate Park, Next to Trade Center,  
BKC, Bandra (East), Mumbai – 400051

**Subject:** Design, Engineering, Supply, Construction, Erection, Testing, Commissioning, and five (05) years comprehensive Operation & Maintenance of 50 MW(AC) grid connected solar PV power plant in the state of Maharashtra

Sl. No.	Name of the equipment/system	Make Proposed by the Bidder	Source of Material (Name of Country)
1.	Solar Photo Voltaic (PV) Modules		
2.	Inverters		
3.	Module Mounting Structure(MMS)		
4.	String Combiner Box		
5.	Inverter Transformers		
6.	Power Transformer		
7.	Auxiliary Transformers		
8.	LT Switchgear		
9.	HT Switchgear		
10.	DC Cables (Module to SCB)		
11.	DC Cables (SCB to Inverter)		
12.	AC Cables (HT &LT)		
13.	Switchyard		



<b>Sl. No.</b>	<b>Name of the equipment/system</b>	<b>Make Proposed by the Bidder</b>	<b>Source of Material (Name of Country)</b>
14.	Balance of item includes all the equipment, materials, mandatory spares, accessories etc. excluding items from 1 to 13.		

Place

Date

Authorized Signature [*In full and initials*]:

Name and Title of Signatory:

Name of the Bidder:

Address:

Seal of the Bidder: \_\_\_\_\_



## ATTACHMENT 13

### PERFORMA FOR MANDATORY INFORMATION REQUIRED TO UPLOAD

To  
Chief General Manager (SEP) (Designation)  
Mahatma Phule Renewable Energy & Infrastructure Technology Limited.  
B-501 Pinnacle Corporate Park, Next to Trade Center,  
BKC, Bandra (East), Mumbai – 400051

**Subject:** Design, Engineering, Supply, Construction, Erection, Testing, Commissioning, and five (05) years comprehensive Operation & Maintenance of 50MW(AC) grid connected solar PV power plant in the state of Maharashtra

1. Company Name

2. Registration Number

3. Registered Address

4. Name of Partners/ Directors

5. Bidder Type : Indian/ Foreign

6. City

7. Postal Code



8. Company's GST number

9. Bank details for payment (including IFSC no.)

10. Company's Legal Status (Tick )

11. Company Category (Tick )



Medium Unit as per MSME

Ancillary Unit

Project Affected Person of this Company

SSI

Others

**Contact Details:**

Enter Company Contact Person  
Details

Title (Tick )

Mrs.

Mr.

Ms.

Dr.

Shri

Contact Name

Date of Birth (DD/MM/YYYY)

Correspondence Email

Designation





Phone Details

e.g: +91 044 22272449

+91

Mobile Number

I, the undersigned, Proprietor/Director/authorized signatory of [*Insert name of the Firm/Agency/Bidder*] do hereby solemnly declare and affirm that the details furnished above are true and correct to the best of my knowledge and belief.

Place

Date

Authorized Signature [*In full and initials*]:

Name and Title of Signatory:

Name of the Bidder:

Address:

Seal of the Bidder:\_\_\_\_\_



## ATTACHMENT 14

### FORMAT FOR MONTH WISE TARGET ENERGY GENERATION FOR THE PROPOSED SOLAR PV PLANT

To

Chief General Manager (SEP) (Designation)

Mahatma Phule Renewable Energy & Infrastructure Technology Limited.

B-501 Pinnacle Corporate Park, Next to Trade Center,

BKC, Bandra (East), Mumbai – 400051

Name of Bidder:

Month	Solar Insolation (kWhr/m <sup>2</sup> )	Target Generation (MWhr) <b>Fixed Mounted</b> (1 Mwp) Quoted by Bidder	Month wise Generation (Mwhr) from Fixed mounted
		A	B=A X .....
January	98.8		
February	116.9		
March	170.5		
April	191.9		
May	205.6		
June	169.6		
July	134.5		
August	137.0		
September	147.2		
October	152.8		
November	115.1		
December	101.2		
<b>Total</b>	<b>1741.1</b>		

#MAHPREIT has right to question the rationality of the month wise quoted generation

Place

Date

Authorized Signature [*In full and initials*]:

Name and Title of Signatory:

Name of the Bidder:

Address:

Seal of the Bidder:\_\_\_\_\_



## ATTACHMENT 15

### UNDERTAKING FOR CONTRACT

*(In compliance of Ministry of Finance, Government of India order no F. No. 6/18/2019-PPD dated 23.07.2020)*

I have read the clause regarding restrictions on procurement from a bidder of a country which shares a land border with India. I certify that (name of Bidder) is not from such a country or, if from such a country, has been registered with the Competent Authority. I hereby certify that

..... (name of Bidder) fulfills all requirements in this regard and is eligible to be considered.

*Note:- Evidence of valid registration by the Competent Authority shall be attached (if applicable)*

Place

Authorized Signature [*In full and initials*]:

Date

Name and Title of Signatory:

Name of the Bidder:

Address:

Seal of the Bidder:\_\_\_\_\_



## ATTACHMENT 16

### FORMAT FOR DECLARATION FOR COMPLIANCE TO ALMM

(On the letter head of bidder)

To Whomsoever This May Concern

Reference: (Tender no. and description)

1. We hereby declare that we are fully aware of the binding provisions of ALMM Order the and the Lists(s) there under, while quoting the tariff in (Name of the tender).
2. We understand that the List - I (Solar PV Modules) of ALMM order, Annexure - I of the OM, issued by MNRE on 10th March, 2021 will be updated by MNRE from time to time. We also understand that the Modules to be procured for this project shall be from the List - I of the ALMM order applicable on the date of invoicing of such modules.
3. We also further understand and accept that we shall be liable for penal action, including but not limited to blacklisting and invocation of performance Bank Guarantee, if we are found not complying with the provisions of ALMM Order, including those mentioned above.

Place

Authorized Signature [*In full and initials*]:

Date

Name and Title of Signatory:

Name of the Bidder:

Address:

Seal of the Bidder:\_\_\_\_\_



## ATTACHMENT 17

### ESTIMATED BILL OF MATERIAL

To  
Chief General Manager (SEP) (Designation)  
Mahatma Phule Renewable Energy & Infrastructure Technology Limited.  
B-501 Pinnacle Corporate Park, Next to Trade Center,  
BKC, Bandra (East), Mumbai – 400051

**Subject:** Design, Engineering, Supply, Construction, Erection, Testing, Commissioning, and five (05) years comprehensive Operation & Maintenance of 50 MW(AC) grid connected solar PV power plant in the state of Maharashtra

Dear Sir(s)

1. Estimated Bill of Quantity for plant of capacity 50 MW(AC) (Bidder is expected to provide detailed Bill of Quantity) [Sample BoQ attached along with the Tender Document.

Sl. No.	Description	Qty for 50 MW
1	Solar Photo Voltaic (PV) Modules	
2	Inverters	
3	Module Mounting Structure (MMS)	
4	String Combiner Box	
5	Inverter Transformers	
6	Power Transformers	
7	Auxiliary Transformers	
8	LT Switchgear	
9	HT Switchgear	
10	DC Cables (Module to SCB)	
11	DC Cables (SCB to Inverter)	
12	AC Cables (HT &LT)	
13	Switchyard	
14	Balance of item includes all the equipment, materials, mandatory spares, accessories	



<b>Sl. No.</b>	<b>Description</b>	<b>Qty for 50 MW</b>
	etc. excluding items from 1 to 13.	

*NOTE: 1. The quoted Solar Modules and Cells to be used in the project shall be sourced only from the Modules and Manufacturers included in the latest "Approved List of Module and Manufacturers" as published by Ministry of New and Renewable Energy (MNRE). The Copy of latest published list shall be submitted with the bid.*

2. The above quantities are tentative. The actual quantity shall be finalized during detail engineering.

Place

Authorized Signature [*In full and initials*]:

Date

Name and Title of Signatory:

Name of the Bidder:

Address:

Seal of the Bidder: \_\_\_\_\_



**ATTACHMENT 18**

**FORMAT FOR TOOLS & TACKLES**

To  
 Chief General Manager (SEP) (Designation)  
 Mahatma Phule Renewable Energy & Infrastructure Technology Limited.  
 B-501 Pinnacle Corporate Park, Next to Trade Center,  
 BKC, Bandra (East), Mumbai – 400051

**Subject:** Design, Engineering, Supply, Construction, Erection, Testing, Commissioning, and five (05) years comprehensive Operation & Maintenance of 50 MW(AC) grid connected solar PV power plant in the state of Maharashtra

Following are the details of Tools & Tackles for the proposed 50 MW(AC) grid connected solar PV power plant in the state of Maharashtra.

SI. No.	Description of Tools	Quantity (Nos.)

Place  
  
Date

Authorized Signature [*In full and initials*]:  
 Name and Title of Signatory:  
 Name of the Bidder:  
 Address:  
 Seal of the Bidder:\_\_\_\_\_



**DECLARATION REGARDING IMPORTED CONTENT**

To  
Chief General Manager (SEP) (Designation)  
Mahatma Phule Renewable Energy & Infrastructure Technology Limited.  
B-501 Pinnacle Corporate Park, Next to Trade Center,  
BKC, Bandra (East), Mumbai – 400051

**Subject:** Design, Engineering, Supply, Construction, Erection, Testing, Commissioning, and five (05) years comprehensive Operation & Maintenance of 50 MW(AC) grid connected solar PV power plant in the state of Maharashtra

We confirm the details of Import Content included in our bid and these details are furnished for the purpose of issuance of Relevant Certificate by the employer as per Clause 3.12.4 of bid document.

<b>Sl. No.</b>	<b>Description of item to be supplied</b>	<b>Quantity</b>
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		
11.		
12.		

Note:

- i. Continuation sheets of like size and format may be used as per bidders' requirements and shall be annexed to this Attachment.*
- ii. The value of import content for the items mentioned above shall be submitted by bidder while submitting the break-up of prices after conclusion*





Place

Date

Authorized Signature [*In full and initials*]:

Name and Title of Signatory:

Name of the Bidder:

Address:

Seal of the Bidder: \_\_\_\_\_



# PRICE BID FORMAT

**Price Bid**

<b>Sr.No</b>	<b>Category of Works</b>	<b>Prices in Rupees</b>
1.	EPC Rate per Unit	
	Total GST in Rupees	
2.	Transportation Charges	
	Total GST in Transportation Charges	
3.	Consultancy Charges	
	Total GST in Consultancy	
4.	Transit Insurance in Rupees	
	Total GST in Transit Insurance	
5.	Aggregate Comprehensive O&M Charges for five (05) years including spares	
	Total GST in O&M Charges	
<b>Total</b>		

**Note:**

1. Bidders shall quote the prices in Rupees only.
2. Bidders shall quote the EPC contract value as well along with EPC Rate per unit for Quoted generation.



**PBRs No-II**

**SCHEDULE OF PRICE FOR COMPREHENSIVE OPERATION & MAINTENANCE OF  
THE SOLAR PV POWER PROJECT FOR 5 YEARS FROM THE COMMERCIAL  
OPERATION DATE (COD) INCLUDING O&M SPARES AND CONSUMABLES**



**PBRs No-III**

**SCHEDULE OF APPLICABLE EXISTING GST RATE ON THE EQUIPMENT  
SUPPLIED UNDER THE FIRST CONTRACT, SECOND AND THIRD CONTRACT**

**(AS ON THE DATE SEVEN (7) DAYS PRIOR TO DEADLINE FOR DATE OF  
SUBMISSION OF BIDS).**



# **ANNEXURES**



**FORMAT OF CONTRACT AGREEMENT**

This Contract Agreement (hereinafter called the "CONTRACT") is made, on the [*Insert day*] day of [*Insert month*] in the year [*Insert year*] at [*Insert place*].

**BETWEEN**

Mahatma Phule Renewable Energy & Infrastructure Technology Limited (hereinafter referred to as "MAHAPREIT", which expression shall, unless repugnant to the context or meaning thereof, be deemed to include its successors and assigns), a Company incorporated under the Companies Act 1956, having its registered office at B-501 Pinnacle Corporate Park, Next to Trade Center, BKC, Bandra (East), Mumbai – 400051 (hereinafter referred to as "MAHAPREIT", which expression shall, unless repugnant to the context or meaning thereof, be deemed to include its successors and assigns) of the one part.

**AND**

[*Insert name of the Contractor*] a Company incorporated under the Companies Act 1956/Companies Act 2013, having its registered office at [*insert address of the registered office of the contractor*] (hereinafter referred to as the "CONTRACTOR", which expression shall, unless repugnant to the context or meaning thereof, be deemed to include its successors and assigns) of the other part

WHEREAS the aforesaid MAHAPREIT has invited Notice Inviting Tender (NIT) for [*Insert Title of Tender*] vide Bid Document No. [*Insert Bid Document No. and date*] and the aforesaid CONTRACTOR had participated in the above referred Tender vide their Bid dated [*Insert the reference no. and date of the bids of the contractor*] and MAHAPREIT has accepted their aforesaid Tender and awarded the CONTRACT for [*Insert scope of the works for this contract*] on the terms and conditions contained in MAHAPREIT's Letter of Award No. ....[*Insert Letter of Award No.*]..... dated ..... [*Insert Date of Letter of Award No.*]..... and the documents referred to therein, which have been unequivocally and unconditionally accepted by CONTRACTOR vide their acceptance dated [*Insert reference of acknowledgment and its date*] to this Letter of Award resulting into this CONTRACT hereinafter called [*Insert name of this Contract*]

AND WHEREAS THE CONTRACTOR has agreed to execute the aforesaid work for the sum of [*Insert value of the Contract*] ([*Insert value of the Contract in words*] upon the terms and subject to the conditions herein mentioned in this CONTRACT.

**NOW THEREFORE the CONTRACTOR and MAHAPREIT hereby undertake and agree as follows:**



**1. The following Documents attached hereto shall be deemed to form an integral part of THE CONTRACT:**

- i. Contract Agreement
- ii. MAHAPREIT's Letter of Award (LoA), duly accepted by you together with its amendments, if any.
- iii. Bid Document including subsequent amendments/clarifications, if any.
- iv. Your Bid Proposal along with Bid Response Sheets, Annexure, etc.
- v. Final/Approved Quality Assurance Plans for manufacturing and site/field activities for all major/critical items.
- vi. Integrity Pact
- vii. Activity Chart/Project Schedule
- viii. Manpower Chart
- ix. Any other document forming part of the Contract

**2. The mutual rights and obligations of the MAHAPREIT and the CONTRACTOR shall be as set forth in the CONTRACT, in particular:**

- i) THE CONTRACTOR shall do and perform all works and things in this contract mentioned and described or which are implied therein or there from respectively or are reasonably necessary for the completion of the works as mentioned and at the times, in the manner and subject to the terms & conditions and stipulations contained in this CONTRACT, and in consideration of the due provision, executions, construction and completion of the works agreed to by the CONTRACTOR.
- ii) THE MAHAPREIT doth hereby covenant with the CONTRACTOR to pay all the sums of money as and when they become due and payable to THE CONTRACTOR under the provisions of the CONTRACT. Such payment to be made at such times and in such manner as laid down in the CONTRACT.
- iii) The conditions and covenants stipulated herein before in this CONTRACT are subject to and without prejudice to the rights of the MAHAPREIT to enforce Liquidated Damages for delays and / or any other rights whatsoever including the right to reject and cancel on default or breach by the CONTRACTOR of the conditions and the covenants as stipulated in the general conditions, specifications, forms, drawing, etc., attached with this CONTRACT.
- iv) The contract value, extent of supply delivery dates, specifications, and other relevant matters may be altered by mutual agreement and if so altered shall not be deemed or construed to mean or apply to affect or alter other terms and conditions of the contract and the general conditions and the contract so altered or revised shall be and shall always be deemed to have been subject to and without prejudice to said stipulation.

**3. MAHAPREIT has also enter into the following Contracts with the Contractor:**

- a. ....
- b. ....





A breach in the performance of any of the Contracts as indicated herein above including this Contract shall be considered as a breach in performance of the other Contracts, which shall confer a right to the MAHAPREIT to terminate the other Contracts also at the risk and cost of the Contractor without prejudice to other rights, the MAHAPREIT may have as per terms & conditions of respective Contract

4. The effective date of this CONTRACT shall be reckoned from [Insert Date of commencement of the contract]

IN WITNESS WHEREOF, the Parties hereto have caused this Contract to be signed in their respective names as of the day, month and year first above written.

For and behalf of MAHAPREIT	For and behalf of M/s_____
Signature	Signature
Name & Address	Name & Address
Designation	Designation
Witness 1	Witness 1
Name & Address	Name & Address
Witness 2	Witness 2
Name & Address	Name & Address



**Annexure 2**

**PROFORMA FOR BANK GUARANTEE FOR CONTRACT PERFORMANCE CUM  
SECURITY GUARANTEE (IN ACCORDANCE WITH CLAUSE NO 3.48.1)**

**(To be stamped in accordance with Stamp Act)**

**Bank Guarantee No. ....**

**Date .....**

To

Chief Finance Officer (Designation)

Mahatma Phule Renewable Energy & Infrastructure Technology Limited.

B-501 Pinnacle Corporate Park, Next to Trade Center,

BKC, Bandra (East), Mumbai – 400051

**Dear Sir,**

In consideration of the ..... [Employer's Name]..... (hereinafter referred to as the 'Employer,' which expression shall unless repugnant to the context or meaning thereof, include its successors, administrators and assigns) having awarded to M/s [Contractor's Name] ..... with its Registered/Head Office at (hereinafter referred to as the 'Contractor', which expression shall unless repugnant to the context or meaning thereof, include its successors administrators, executors and assigns), a Contract by issue of Employer's Letter of Award No. .... dated ..... and the same having been unequivocally accepted by the Contractor, resulting into a contract bearing No dated.....valued at ..... for ..... and the Contractor having agreed to provide a Contract Performance cum Security Guarantee for the faithful performance of the entire Contract equivalent to ..... (\*) ..... % ( percent) of the said value of the Contract to the Employer.

We ..... [Name & Address of the Bank] ..... having its Head Office at .....(hereinafter referred to as the 'Bank', which expression shall, unless repugnant to the context or meaning thereof, include its successors, administrators, executors and assigns) do hereby guarantee and undertake to pay the Employer, on demand any and all money payable by the contractor to the extent of ..... (\*) ..... as aforesaid at any time upto .....(@) ..... [days/month/year] without any demur, reservation, context, recourse or protest and/or without any reference to the Contractor. Any such demand made by the Employer on the Bank shall be conclusive and binding notwithstanding any difference between the Employer and the Contractor or any dispute pending before any Court, Tribunal, Arbitrator or any other authority. The Bank undertakes that the guarantee shall be irrevocable and valid till the completion of



faithful performance of the Contract to the satisfaction of the Employer and/ or the Employer in writing discharges the Guarantee.

The Employer shall have the fullest liberty, without affecting in any way the liability of the Bank under this guarantee, from time to time to extend the time for performance of the Contract by the Contractor. The Employer shall have the fullest liberty, without affecting this guarantee, to postpone from time to time the exercise of any powers vested in them or of any right which they might have against the Contractor, and to exercise the same at any time in any manner, and either to enforce or to forbear to enforce any covenants, contained or implied, in the Contract between the Employer and the Contractor or any other course or remedy or security available to the Employer. The Bank shall not be released of its obligations under these presents by any exercise by the Employer of its liberty with reference to the matters aforesaid or any of them or by reason of any other act or forbearance or other acts of omission or commission on the part of the Employer or any other indulgence shown by the Employer or by any other matter or thing whatsoever which under law would, but for this provision, have the effect of relieving the Bank.

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

Our liability under the captioned guarantee is restricted to Rs..... (Rupees in words.....) and the guarantee will remain in force upto and including the date ..... (date of validity) and unless the claim under the guarantee is made on us before the date ..... (within 60 days beyond the validity date), all your rights under the said guarantee shall be forfeited and we shall be released and discharged from all liabilities thereafter.

Witness 1	Witness 1
Signature	Signature
Name & Address	Name & Address

(Official Address)

(Designation with Bank Stamp)



Power of Attorney No. ....

Date .....

**Notes:**

*(\*)This amount will be in accordance with Clause No 3.48.1 of this Bid Document as the case may be.*

*(@)This date will be in accordance with Clause No 3.48.1 of this Bid Document as the case may be.*

1. The original bank guarantee against the CPSG should be sent to MAHAPREIT directly under Regd. Post (A.D.) by the issuing bank / branch. Where the original bank guarantee against CPSG is handed over to the bidder, the bidder shall ensure that a copy of the bank guarantee against CPSG duly signed by the authorized representative of issuing bank along with covering letter has been sent immediately by the issuing bank/branch under Regd. Post (A.D.) directly to MAHAPREIT at the address mentioned in the bid document.
2. The bank guarantee shall be issued by any Nationalized Bank / Scheduled Bank



### Annexure 3

## PROFORMA FOR BANK GUARANTEE FOR ADVANCE PAYMENT

(To be stamped in accordance with Stamp Act)

**Bank Guarantee No. ....**

**Date .....**

To

Chief General Manager (SEP) (Designation)

Mahatma Phule Renewable Energy & Infrastructure Technology Limited.

B-501 Pinnacle Corporate Park, Next to Trade Center,

BKC, Bandra (East), Mumbai – 400051

Dear Sir,

In consideration of [*Insert Employer's Name*] (hereinafter referred to as the 'Employer', which expression shall, unless repugnant to the context or meaning thereof include its successors, administrators and assigns) having awarded to M/s [*Insert Contractor's Name*] with its Registered/Head Office at [*Insert address of Contractor's Registered Office*] (hereinafter referred to as the 'Contractor' which expression shall unless repugnant to the context or meaning thereof, include its successors, administrators, executors and assigns), a Contract, by issue of Employer's Letter of Award No. [*Insert Letter of Award No.*] dated [*Insert date of Letter of Award*] and the same having been unequivocally accepted by the Contractor, resulting into a Contract bearing No. [*Insert Contract Bearing No.*] dated [*Insert date of Contract*] valued at [*Insert Value of Contract*] for [*Insert Name of Contract*] (hereinafter called the 'Contract') and the Employer having agreed to make an advance payment to the Contractor for performance of the above Contract amounting [*Insert Amount of Advances as per Clause no. 3.50.4(i) , in Figures*] ( [*Insert Amount of Advance as per Clause no. 3.50.4(i), in words*]) as an Advance against Bank Guarantee to be furnished by the Contractor.

We[*Insert name and address of the Bank*] having its Head Office at [*Insert registered Head Office address of the Bank*] (hereinafter referred to as the 'Bank', which expression shall, unless repugnant to the context or meaning thereof, include its successors, administrators, executors and assigns) do hereby guarantee and undertake to pay the Employer, immediately on demand any or, all monies payable by the Contractor to the extent of [*Insert a value equivalent to 110% of advance amount as per clause no 3.50.4, in figures in words*] as aforesaid at any time upto including.....(@).....without any demur, reservation, contest, recourse or protest and/or without any reference to the Contractor. Any such demand made by the Employer on the Bank shall be conclusive and binding



notwithstanding any difference between the Employer and the Contractor or any dispute pending before any Court, Tribunal, Arbitrator or any other authority.

The Bank undertakes not to revoke this guarantee during its currency without previous consent of the Employer and further agrees that the guarantee herein contained shall be enforceable till thirty (30) days after expiry of its validity.

The Employer shall have the fullest liberty without affecting in any way the liability of the Bank under this guarantee, from time to time to vary the advance or to extend the time for performance of the Contract by the Contractor. The Employer shall have the fullest liberty without affecting this guarantee, to postpone from time to time the exercise of any powers vested in the more of any right which they might have against the Contractor, and to exercise the same at any time in any manner, and either to enforce or to forbear to enforce any covenants, contained or implied, in the Contract between the Employer and the Contractor or any other course or remedy or security available to the Employer. The Bank shall not be released of its obligations under these presents by any exercise by the Employer of its liberty with reference to the matters aforesaid or any of the more by reason of any other actor forbearance or other acts of omission or commission on the part of the Employer or any other indulgence shown by the Employer or by any other matter or thing whatsoever which under law would but for this provision, have the effect of relieving the Bank.

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

Notwithstanding anything contained hereinabove our liability under this guarantee is limited to [Insert a value equivalent to 110% of advance amount] and it shall remain in force upto and including .....(@).....and shall be extended from time to time for such period (not exceeding one year),as may be desired by M/s[Contractor's Name] on whose behalf this guarantee has been given.

Dated this..... day of .....20xx..... at.....

Witness 1	Witness 1
Signature	Signature
Name & Address	Name & Address



(Official Address)

(Designation with Bank Stamp)

Power of Attorney No. ....

Date .....

**Note:**

1. (@) This date shall be sixty (60) days beyond the date of Completion of the last facility covered under the Contract.
2. The Bank Guarantee shall be from a Nationalized/ scheduled Bank.
3. The BG should be on Non-judicial stamp-paper/e-stamp paper of appropriate value as per stamp Act prevailing in the state(s) where the BG is submitted or is to be acted upon or the rate prevailing in the state where the BG is executed, whichever is higher. The stamp paper/e-stamp paper shall be purchased in the name of bidder/Bank issuing the guarantee.



**Annexure 4**

**FORMAT OF INDEMNITY BOND TO BE EXECUTED BY THE CONTRACTOR FOR THE EQUIPMENT HANDED OVER IN INSTALLMENTS BY THE EMPLOYER FOR PERFORMANCE OF ITS CONTRACT**

(On non-Judicial stamp paper of appropriate value)

**INDEMNITY BOND**

THIS INDEMNITY BOND is made this.....day of..... 20xx.....by..... (Contractor's Name) a Company registered under the Companies Act, 1956/ the Companies Act, 2013/Partnership firm/Proprietary concern having its Registered Office at..... (hereinafter called as 'Contractor' or "Obligor" which expression shall include its successors and permitted assigns) in favour of .....(Name of Employer), a Company incorporated under the Companies Act, 1956 having its Registered Office at ..... and its project at ..... (Hereinafter called "{Abbreviated name of the Employer}") Which expression shall include its successors and assigns):

WHEREAS .....@..... has awarded to the Contractor a Contract for .....vide its Notification of Award/Contract No.....dated..... and it's Amendment No and Amendment No. .... , (applicable when amendments have been issued) (hereinafter called the Contract") in terms of which .....@..... is required to hand over various Equipment to the Contractor for execution of the Contract.

And WHEREAS by virtue of Clause No..... of the said Contract, the Contractor is required to execute an Indemnity Bond in favour of .....@..... for the Equipment handed over to it by .....@..... for the purpose of performance of the Contract/Erection portion of the contract (hereinafter called the "Equipment")

NOW THEREFORE, This Indemnity Bond witnesseth as follows:

1. That in consideration of various Equipment as mentioned in the Contract, valued at (*Currency and amount in figures*)..... (*Currency and amount in words*) ..... to be handed over to the Contractor in installments from time to time for the purpose of performance of the Contract, the Contractor hereby undertakes to indemnify and shall keep.....@..... indemnified, for the full value of equipment .The Contractor hereby acknowledges actual receipt of the initial installment of the Equipment etc. as per details in the Schedule appended hereto. Further, the Contractor agrees to acknowledge actual receipt of the subsequent installments of the Equipment etc. as required by .....@..... in the form of Schedules





consecutively numbered which shall be attached to this Indemnity Bond so as to form integral parts of this Bond. The Contractor shall hold such Equipment etc. in trust as a "Trustee" for and on behalf of.....@.....

2. That the Contractor is obliged and shall remain absolutely responsible for the safe transit/protection and custody of the Equipment at .....@..... project site against all risks whatsoever till the Equipment are duly used/erected in accordance with the terms of the Contract and the plant/package duly erected and commissioned in accordance with the terms of the Contract, is taken over by .....@..... . The Contractor undertakes to keep .....@ harmless against any loss or damage that may be caused to the Equipment
3. The Contractor undertakes that the equipment shall be used exclusively for the performance/execution of the Contract strictly in accordance with its terms and conditions and no part of the equipment shall be utilised for any other work of purpose whatsoever. It is clearly understood by the Contractor that non-observance of the obligations under this Indemnity Bond by the Contractor shall inter-alia constitute a criminal breach of trust on the part of the Contractor for all intents and purpose including legal/penal consequences.
4. That .....@..... is and shall remain the exclusive Employer of the Equipment free from all encumbrances, charges or liens of any kind, whatsoever. The Equipment shall at all times be open to inspection and checking by the Engineer-in-Charge or other employees/agents authorized by him in this regard. Further, .....@ shall always be free at all times to take possession of the Equipment in whatever form the Equipment may be, if in its opinion, the equipment s are likely to be endangered, mis-utilised or converted to uses other than those specified in the Contract, by any acts of omission or commission on the part of the Contractor or any other person or on account of any reason whatsoever and the Contractor binds himself and undertakes to comply with the directions of demand of .....@ to return the Equipment without any demur or reservation.
5. That this Indemnity Bond is irrevocable. If at any time any loss or damage occurs to the Equipment or the same or any part thereof is mis-utilised in any manner whatsoever, then the Contractor hereby agrees that the decision of the Engineer-in-Charge of .....@..... as to assessment of loss or damage to the Equipment shall be final and binding on the Contractor. The Contractor binds itself and undertakes to replace the lost and/or damaged Equipment at its own cost and/or shall pay the amount of loss to.....@..... without any demur, reservation or protest. This is without prejudice to any other right or remedy that may be available to .....@ against the Contractor under the Contract and under this Indemnity Bond.



6. NOW THE CONDITION of this Bond is that if the Contractor shall duly and punctually comply with the terms and conditions of this Bond to the satisfaction of @ , THEN, the above Bond shall be void, but otherwise, it shall remain in full force and virtue.

IN WITNESS WHEREOF, the Contractor has hereunto set its hand through its authorized representative under the common seal of the Company, the day, month and year first above mentioned.

SCHEDULE NO 1

<b>Particulars of the equipment handed over</b>	<b>Quantity</b>	<b>Particulars of dispatch title documents</b>	<b>Value of Equipment</b>	<b>Signature of Attorney in token of receipt</b>

For and behalf of MAHAPREIT	For and behalf of M/s_____
Signature	Signature
Name & Address	Name & Address
Designation	Designation
Witness 1	Witness 1
Name & Address	Name & Address
Witness 2	Witness 2
Name & Address	Name & Address



Indemnity Bonds are to be executed by the authorized persons and (i) in case of contracting Company under common seal of the Company or (ii) having the power of attorney issued under common seal of the company with authority to execute Indemnity Bonds.

In case of (ii), the original Power of Attorney if it is specifically for this contract or a Notarized copy of the Power of Attorney if it is a General Power of Attorney and such documents should be attached to Indemnity Bond.



## Annexure 5

### INDEMNITY BOND TO BE EXECUTED BY THE CONTRACTOR FOR THE REMOVAL / DISPOSAL OF SCRAP/DISPOSAL OF SURPLUS MATERIAL

(TO BE EXECUTED ON STAMP PAPER OF APPROPRIATE VALUE)

#### INDEMNITY BOND

This INDEMNITY BOND executed this ..... day of ..... 20..... by [Name of Company]....., a Company registered under the Companies Act, 1956/ the Companies Act, 2013/Partnership Firm/ Proprietary Concern and having its registered office(s) at .....(Office Address)....., hereinafter called the Indemnifier(s)/Contractor(s) (which expression shall, unless excluded by or repugnant to the context, be deemed to mean and include its successors, administrators, executors and permitted assigns).

#### IN FAVOUR OF

Mahatma Phule Renewable Energy & Infrastructure Technology Limited (hereinafter referred to as "MAHAPREIT", which expression shall, unless repugnant to the context or meaning thereof, be deemed to include its successors and assigns), a Company incorporated under the Companies Act 1956, having its registered office at B-501 Pinnacle Corporate Park, Next to Trade Center, BKC, Bandra (East), Mumbai - 400051 (hereinafter referred to as "MAHAPREIT")

3. MAHAPREIT has awarded the Contractor(s), contract for execution of work ("Scope of Work") as mentioned in the contract agreement no..... dated ....., entered into between MAHAPREIT and Contractor(s), relating to (Name & Address of Project/Station) ..... (hereinafter called 'the Project').
4. The Indemnifier(s) for the purpose of execution of its Scope of Work had from time to time procured and stored .....(Details of Material) at the Project Site.
5. After completion of the Scope of Work by Indemnifier(s), it has been identified that scrap ..... (Details of Scrap Material & its Quantity).....and/or surplus ..... (Details of Surplus Material & its Quantity)..... belonging to Indemnifier(s) is lying at the said Project Site.
6. Now, the scrap ..... (Details of Scrap Material & its Quantity).....and/or surplus .....(Details of Surplus Material & its Quantity) belonging to the Indemnifier(s), requires to be removed by Indemnifier(s) from the Project Site.

NOW THEREFORE THIS INDEMNITY BOND WITNESSETH AS UNDER:

1. That Indemnifier(s) by way of this indemnity requests MAHAPREIT to issue



approval in favour of Indemnifier(s) for removal of scrap .....(Details of Scrap Material & its Quantity).....and/or surplus .....(Details of Surplus Material & its Quantity).....belonging to Indemnifier(s), from the project.

2. That the Indemnifier(s) shall ensure clearing of its scrap ..... (Details of Scrap Material & its Quantity).....and/or surplus ..... (Details of Surplus Material & its Quantity)by\_\_\_\_\_itself, as aforesaid.
3. That Indemnifier(s) in consideration of the premises above, for itself and its respective, executors, administrators and assigns, jointly and severally agree and undertake from time to time and at all times hereafter to indemnify MAHAPREIT and keep MAHAPREIT indemnified from and against all claims, demands, actions, liabilities and expenses which may be made or taken against or incurred by MAHAPREIT by reason of the issue of necessary approval by MAHAPREIT and permitting Indemnifier(s) to remove scrap .....(Details of Scrap Material & its Quantity) and/or surplus .....(Details of Surplus Material & its Quantity)..... belonging to Indemnifier(s), from the project.
4. That Indemnifier(s) undertakes to indemnify and keep MAHAPREIT harmless from any act of omission or negligence on the part of the Contractor in following the statutory requirements with regard to removal/disposal of scrap and surplus belonging to Indemnifier(s), from the Project Site aforesaid, by the Indemnifier(s). Further, in case the laws require MAHAPREIT to take prior permission of the relevant Authorities before handing over the scrap and/or surplus to the Indemnifier, the same shall be obtained by the Indemnifier on behalf of MAHAPREIT.

IN WITNESS WHEREOF, the Indemnifier(s), through its authorized representative, has executed these presents on the Day, Month and Year first mentioned above at \_\_\_\_\_(Name of Place) on \_\_\_\_\_(Date).

Witness:  
Indemnifier

1. ....
  - 2.
- (Authorised Signatory)



## Annexure 6

### INDEMNITY BOND TO BE EXECUTED BY THE CONTRACTOR FOR THE PLANT HANDED OVER BY MAHAPREIT FOR PERFORMANCE OF ITS O&M CONTRACT (ENTIRE SOLAR PHOTO VOLTAIC PLANT)

(TO BE EXECUTED ON STAMP PAPER OF APPROPRIATE VALUE)

#### **INDEMNITY BOND**

THIS INDEMNITY BOND is made on this ..... day of ..... 20.....by ..... a Company registered under the Companies Act, 1956/ the Companies Act, 2013/Partnership Firm/Proprietary concern having its Registered Office at..... (hereinafter called as "Contractor" or "Obligator" which expression shall include its successors and permitted assigns) in favour of MAHAPREIT, a Company incorporated under the Companies Act, 1956 having its Registered Office at B-501 Pinnacle Corporate Park, Next to Trade Center, BKC, Bandra (East), Mumbai – 400051 and its Project at Sangli District in state of Maharashtra;

WHEREAS MAHAPREIT has awarded to the Contractor a Contract for vide its Award Letter/Contract No..... dated and its Amendment No.....

and Amendment No.....(applicable when amendments have been issued) (hereinafter called the "Contract") in terms of which MAHAPREIT is required to hand over various Equipment and facilities provided under Supply Contract, Erection Contract, herein after called "Solar Photo Voltaic Plant" to the Contractor for execution of the Contract.

AND WHEREAS by virtue of Clause No. 3.32.4 of the said Contract, the Contractor is required to execute an Indemnity Bond in favour of MAHAPREIT for the Solar Photo Voltaic Plant handed over to it by MAHAPREIT for the purpose of Performance of the Contract/O&M portion of the Contract.

NOW THEREFORE THIS INDEMNITY BOND WITNESSETH AS UNDER

1. That in consideration of Solar Photo Voltaic Plant as mentioned in the Contract, Valued at Rs.....#..... (Rupees.....) handed over to the Contractor for the purpose of Performance of the Contract, the Contractor hereby undertakes to indemnify and shall keep MAHAPREIT indemnified, for the full value of the Solar Photo Voltaic Plant. The Contractor hereby acknowledges actual receipt of the Solar Photo Voltaic Plant as detailed in the Schedule appended hereto. The Contractor shall hold such Solar Photo Voltaic Plant in trust as a "Trustee" for and on behalf of MAHAPREIT.



2. That the Contractor is obliged and shall remain absolutely responsible for the safe O&M/protection and custody of the Solar Photo Voltaic Project against all risks whatsoever till completion of O&M Contract in accordance with the terms of the Contract and is taken over by MAHAPREIT. The Contractor undertakes to keep MAHAPREIT harmless against any loss or damage that may be caused to the Solar Photo Voltaic Plant.
3. The Contractor undertakes that the Solar Photo Voltaic Plant shall be used exclusively for the Performance/execution of the Contract strictly in accordance with its terms and conditions and no part of the Solar Photo Voltaic Plant shall be utilized for any other work or purpose whatsoever. It is clearly understood by the Contractor that non-observance of the obligations under this Indemnify Bond by the Contractor shall inter-alia constitute a criminal breach of trust on the part of the Contractor for all intents and purposes including legal/penal consequences.
4. That MAHAPREIT is and shall remain the exclusive Employer of the Solar Photo Voltaic Plant free from all encumbrances, charges or liens of any kind, whatsoever. The Solar Photo Voltaic Plant shall at all times be open to inspection and checking by Engineer-in-Charge or other employees/agents authorized by him in this regard. Further, MAHAPREIT shall always be free at all times to take possession of the Solar Photo Voltaic Plant in whatever form the Solar Photo Voltaic Plant may be, if in its opinion, the Solar Photo Voltaic Plant are likely to be endangered, mis-utilized or converted to uses other than those specified in the Contract, by any acts of omission or commission on the part of the Contractor or any other person or on account of any reason whatsoever and the Contractor binds itself and undertakes to comply with the directions or demand of MAHAPREIT to return the Solar Photo Voltaic Plant without any demur or reservation.
5. That this Indemnity Bond is irrevocable. If at any time any loss or damage occurs to the Solar Photo Voltaic Plant or the same or any part thereof is mis-utilized in any manner whatsoever, then the Contractor hereby agrees that the decision of the Engineer-in-Charge of MAHAPREIT as to assessment of loss or damage to the Solar Photo Voltaic Plant shall be final and binding on the Contractor. The Contractor binds itself and undertakes to replace the lost and/or damaged Solar Photo Voltaic Plant at its own cost and / or shall pay the amount of loss to MAHAPREIT without any demur, reservation or protest. This is without prejudice to any other right or remedy that may be available to MAHAPREIT against the Contractor under the Contract and under this Indemnify Bond.
6. NOW THE CONDITION of this Bond is that if the Contractor shall duly and punctually comply with the terms of and conditions of this Bond to the satisfaction of MAHAPREIT, THEN, the above Bond shall be void, but otherwise, it shall remain in full force and virtue.

IN WITNESS WHEREOF, the Contractor has hereunto set its hand through its authorized



representative under the common seal of the Company, the day, month and year first above mentioned.

SCHEDULE

<b>Particulars of the Equipment / Facilities handed-over</b>	<b>Quantity</b>	<b>Value</b>	<b>Other details, (if any)</b>	<b>Signature of Attorney intoken of receipt</b>

For and behalf of MAHAPREIT	For and behalf of M/s_____
Signature	Signature
Name & Address	Name & Address
Designation	Designation
Witness 1	Witness 1
Name & Address	Name & Address
Witness 2	Witness 2
Name & Address	Name & Address

\* Indemnity Bonds are to be executed by the authorized persons and (i) in case of contracting Company under common seal of the Company or (ii) having the power of attorney issued under common seal of the company with authority to execute Indemnity Bonds.

In case of (ii), the original Power of Attorney if it is specifically for this contract or a Notarized copy of the Power of Attorney if it is a General Power of Attorney and such documents should be attached to Indemnity Bond.

# The value shall be sum of Supply and Erection Contract value.





**BID SECURITY FORMAT – BANK GUARANTEE**

(To be stamped in accordance with Stamp Act, if any, of the country of the issuing Bank)

Bank Guarantee No. ....

Date. ....

To

Chief Finance Officer (Designation)

Mahatma Phule Renewable Energy & Infrastructure Technology Limited.

B-501 Pinnacle Corporate Park, Next to Trade Center,

BKC, Bandra (East), Mumbai – 400051.

In accordance with Invitation for Bids under your Bid Document No..... having its Registered/ Head Office at\_\_\_\_\_ (hereinafter called the Bidder') wish to participate in the said bid for Design, Engineering, Supply, Construction, Erection, Testing, Commissioning, and five (05) years comprehensive Operation & Maintenance of 50 MW(AC) grid connected solar PV power plant in the state of Maharashtra.

As an irrevocable bank guarantee against Bid Security for an amount of (\*) .....valid upto 120 days after .....(\*\*)..... required to be submitted by the Bidder as a condition precedent for participation in the said bid which amount is liable to be forfeited on the happening of any contingencies mentioned in the Bidding Documents.

We, the [Name& address of the Bank] ..... having our Head Office at .....(#)..... guarantee and undertake to pay immediately on demand by MAHAPREIT, The amount of .....(\*) without any reservation, protest, demand and recourse. Any such demand made by the 'Owner' shall be conclusive and binding on us irrespective of any dispute or difference raised by the Bidder.

This Guarantee shall be irrevocable and shall remain valid upto .....@..... If any further extension of this guarantee is required, the same shall be extended to such required period (not exceeding one year) on receiving instructions from M/s .....On whose behalf this guarantee is issued.



In witness where of the Bank, through its authorised officer, has set its hand and stamp on Dated this.....day of.....20... at.....

WITNESS

.....  
 .....

(Signature) (Signature)

.....  
 .....

(Name) (Name)

.....  
 .....

(Official Address) (Designation with Bank Stamp)

Attorney as per Power of

Attorney No.....

Date.....

- NOTE: 1. (\*) The amount shall be as specified in NIT  
 (\*\*\*) This shall be the date of expiry of Bids validity  
 (#) Complete mailing address of the Head Office of the Bank to be given

(@)This date shall be forty-five (45) days after the last date for which the bid is valid

2. The Bank Guarantee should be issued by the bank meeting the requirement specified in clause 2.8 of bid document.

3.The Stamp Paper of appropriate value shall be purchased in the name of guarantee issuing Bank.



4. Power of attorney no. and date as well as signature & full name & designation of executants along with Bank's stamp are there. Signature, full name, designation & address of witness are there.

**\*\*\*\*\*END OF SECTION\*\*\*\*\***



## **SECTION – V**

# **TECHNICAL SPECIFICATIONS**



## Section –V: Technical Specifications

### I. PROJECT INFORMATION

#### 1. PROJECT OVERVIEW

The proposed 50MW(AC) Solar PV Project lies around the coordinates 17°14'20" N and 74°86'36" E at an altitude of approximately 453m, above mean sea level. The site is located near *Ghatnandre Village in Sangli* district in State of Maharashtra.

The Project shall comprise the rated AC installed inverter capacity of the plant shall be **50MW<sub>AC</sub>**. The Bidder shall choose the DC/AC ratio however, they must have to ensure the minimum CUF of 19% post one year of COD of the Project for the life of the project.

#### 1.1. PV PLANT CONCEPT

The 50MW<sub>AC</sub> solar PV plant shall be configured into typical inverter stations with a maximum of four inverters in an inverter station. Depending upon the inverter capacity selection inverter stations can be maximum sized up to 8-10MW<sub>AC</sub>. In order to minimize DC ohmic losses, inverters, MV transformers and switchgear shall be centrally located within the typical modular block.

Multiple winding ONAF type transformers limited to 5 windings can be used for stepping up the inverter output voltage to 33kV.

The output of such 33kV ring main units shall be combined at main 33kV switchboard and further fed to power transformer to step the voltage to 220kV. Point of interconnection and performance monitoring shall remain at the 33kV located at pooling substation.

#### 1.2. SITE OVERVIEW

##### 1.2.1. LOCATION & APPROACH

Location	Sangli, Maharashtra
Nearest Highway	National Highway 166H
Nearest Railway Station	Sangli Railway Station /Miraj Railway Station
Nearest Commercial Airport	Pune International Airport
Indicative Coordinate	17.174°N, 74.866°E



### 1.2.2. LAND AVAILABILITY

Land Availability	Plant will be located near villages Kundalapur, Tisangi, Rajuri and Ghatnadre Approximately 200 acres of land will be acquired for developing a 50MWAC Solar PV Plant. Bidders may note that the land availability at aforementioned locations is indicative. Alternative land location nearby to the substation or aforementioned may be prescribed while issuing the Notice to Proceed post award of LOA by MAHAPREIT to initiate the scope of work.
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### 1.2.3. WEATHER

The climate of Sangli district is on the whole agreeable and is characterized by general dryness in the major part of the year. The cold season is from December to about the middle of February. The hot season which follows, lasts till the end of May. June to September is the south-west monsoon season and the two months, October and November, constitute the post-monsoon or retreating monsoon season. The average annual rainfall in the district is 692.4 mm (27.26"). The rainfall in the western portion of the district, near the western ghats is considerably higher than in the rest of the district.

## 2. SOLAR PLANT TECHNOLOGY

MAHAPREIT has opted to develop the project based on Advance Crystalline Solar PV modules. Contractor can decide upon the choice of module mounting arrangement with fixed/seasonal/east-west tracking system or combination, and/or String/Central Inverters. However, the Contractor have to ensure the minimum CUF of 19%.

## 3. POWER EVACUATION

Power evacuation shall be 132 kV voltage through 02 nos 132 kV line and the bays shall be connected at 220 kV Ghantrandare substation of MSETCL.

## 4. GENERATION GUARANTEE

The annual solar generation has to be quoted by the Bidder in MU in the relevant section of the Bid Document. The Bidder shall guarantee the Quoted Annual Energy Generation at metering point in the first year of O&M period after Operational Acceptance Test. Bidder shall adopt module mounting arrangement with fixed/seasonal/east-west tracking system or combination of any of the above to achieve the quoted generation.



## 5. OTHER DETAILS

S. No.	ITEM	DETAILS
1.	Water requirement during construction	To be arranged by Bidder
2.	Power requirement during construction	To be arranged by Bidder
3.	MOEF Clearance	To be arranged by MAHAPREIT
4.	SPCB Clearance	To be arranged by MAHAPREIT
5.	MNRE Clearance	To be arranged by Bidder
6.	Chief Electrical Inspector Clearance	To be arranged by Bidder
7.	Connectivity with MSETCL substation	To be arranged by MAHAPREIT



## II. DESIGN CONSIDERATION AND SCOPE OF SUPPLY & SERVICES

### 1. INTENT OF SPECIFICATION

The scope of the proposal for the Design Engineering, Supply, Construction, Erection, Testing, Commissioning including five (05) years Operation and Maintenance (O&M) works of the Solar PV plant on turnkey basis completely covering the following activities and services in respect of all the equipment & works specified and covered under the specifications and read in conjunction with "Scope of Supply & services" elaborated elsewhere.

All equipment, materials and services whether explicitly stated or otherwise and that are necessary for the satisfactory operation of the Solar PV system as per prevailing technical standards and requirements and its integration with the existing ac systems as described in the specification shall be deemed to be included in the scope of work of the Contractor and shall not be limited to the following:

- Basic Engineering of the plant and systems.
- Detailed design of all the equipment and equipment system(s) including civil works.
- Providing, Review and approval of engineering drawings, data, process Calculations, test procedures, structural design calculations, Equipment layout, Drawings/Data sheets of bought out items, civil structural/architectural Drawings, Performance & Guarantee Test procedure etc.
- Providing Operation & Maintenance/ instruction manuals, as built drawings and other information.
- Providing training of Employer's personnel
- Finalization of sub-vendors, manufacturing quality plans and Field quality plans.
- Complete manufacturing including conducting all type, routine and acceptance tests; Civil, Structural and Architectural works to the extent applicable, including construction facilities and construction power distribution.
- Packing and transportation from the manufacturer's works to the site including customs clearance & port clearance, port charges, (if any).
- Receipt, storage, preservation and conservation of equipment at the site; Fabrication, pre-assembly, (if any), erection, testing, pre-commissioning and commissioning and putting into satisfactory operation all the equipment including successful completion of initial operation
- Reliability and Functional guarantee tests after successful completion of trial operation;
- Supply of spares
- Satisfactory completion of the contract.
- Special tools and tackles if any required for maintenance of the plant.
- Operation and maintenance of the solar plant





- 1.1. The work to be carried out as per the above scope shall be all in accordance with the requirements, conditions, appendices etc. given in Technical Specifications (Section- VI) together with those stated in other Sections/Sub-sections of Bid Documents which shall be considered as a part of this volumes completely as if bound herewith. It is not the intent to specify herein all aspects of design and construction nevertheless, the equipment's and civil works shall conforming all aspects to high standard of engineering, design and workmanship and shall be capable of performing in continuous commercial operation in a manner acceptable to the Employer, who will interpret the meaning of the specification and drawings and shall have a right to reject or accept any work or material which in his assessment is not complete to meet the requirements of this specification and/or applicable Indian / International standards mentioned elsewhere in this specification. The Bidder shall be responsible for providing all materials, equipment and services, specified or otherwise (unless specifically excluded) which are required to fulfill the intent of ensuring operability and the reliability of the complete system covered under this specification.
- 1.2. Bidders are requested to carefully examine and understand the specifications and seek clarifications, if required, to ensure that they have understood the specifications. Such clarifications should be sought within the time period as stipulated in section ITB. Bidder's offer should not carry any sections like clarifications, interpretations and/or assumptions. However, if the bidder feels that, in his opinion, certain features brought out in his offer are superior to what has been specified, these may be highlighted separately.
- 1.3. The Bidder shall be responsible for providing all material, equipment and services, specified or otherwise which are required to fulfill the intent of specification and ensuring operability, maintainability and the reliability of the complete work covered under this specification.
- 1.4. Failure of any equipment to meet the specified requirements of tests carried out at works or at site shall be sufficient cause for rejection of the equipment. Rejection of any equipment will not be held as a valid reason for delay in completion of the works as per schedule. Contractor shall be responsible for removing all deficiencies and supplying the equipment that meet the requirement.
- 1.5. Before submitting his bid, the bidder should inspect and examine the site and its surroundings and should satisfy himself as to the nature of the ground and subsoil, the quantities and nature of work, materials necessary for completion of the work and their availability, means of access to site and in general shall himself obtain all necessary information as to risks, contingencies and other circumstances which may influence or affect his offer. No consequent extra claims on any misunderstanding or otherwise shall be allowed by the Employer.



## 2. BASIC ENGINEERING DESIGN PARAMETER OF SOLAR PV PLANT

### 2.1. **Minimum Plant Capacity:**50 MW.

- a) Plant capacity is cumulative capacity of Inverters
- b) Inverter Transformer capacity shall not be less than the sum of the connected Inverter capacity.

### 2.2. **Inverter Capacity:** The continuous combined rating of all PCUs shall not be less than Plant capacity at unit power factor at ambient temperature of 50 deg C and 0.95 p.f. at 40 deg C.

### 2.3. **33 kV Switchgear:**

- 33kV Bus Bar rating shall be as per single line diagram approved by MAHAPREIT
- 33kV Switchgears system fault current rating shall be as single line diagram. Dynamic withstand current rating shall be 2.5 times of system fault current.
- Spare 33 kV breaker panels with VCB, relay and all other accessories shall be provided. VCB with protection relay shall be used at all switchgear panels including 33kV Aux transformer feeder (if provided).
- DC supply shall be used for control and protection system of switchgear. In case UPS AC supply are considered for auxiliary control and protection supply for switchgear, then suitable rated AC/DC converter/power pack shall be used to meet the DC control supply requirement of switchgear panels.
- HT switchgear shall be indoor or outdoor type.
- The 33kV Switchgears (both indoor and outdoor type) shall have an internal Arc Classification of IAC FLR 12.5kA, 1sec.

### 2.4. **Outdoor containerized solution/compact** substation with inverter, inverter transformer & HT switchgear as inverter station are acceptable. However, technical specification of inverter, HT switchgear and inverter transformer as per relevant chapter of technical specification shall be applicable.

### 2.5. **Nos. of Earth Pit for DC System:**

Nos. of Earth Pit*	Plant Capacity
1No. earth pit at every 1 MW	For Solar Plant DC Capacity of 50 MW or less
1No. earth pit at every 1.25 MW	For Solar Plant DC Capacity greater than 50 upto 100 MW

*\*Nos. of earth pit indicated is valid if all the earth pits are interconnected in*



*single mesh of earth pits.*

Nos. of Gates for the Solar plot boundary: 05 nos (min.)

Nos of water Borewell for Module Cleaning System: 03 nos (min.)

2.6. Metering: ABT Meter has to be provided

- All outgoing 132 kV Line from 132 kV switchyard as per SLD
- 132 kV side of 33/132 kV transformer as per tender SLD

2.7. Licenses for Remote (web) Monitoring of Scada: 2 Nos concurrent viewing.

2.8. The detailed scope of work in accordance with this specification is elaborated below. The scope of the contractor shall be deemed to include all such items which although are not specifically mentioned in the bid documents and/or in contractor's proposal but are needed to make the system complete in all respects for its safe, reliable, efficient and trouble-free operation and the same shall be furnished and erected unless otherwise specifically excluded as per Section Terminal Points & Exclusions.

### 3. SCOPE OF WORK

Detailed design of Grid Interactive Solar PV Plant and its associated civil, electrical & mechanical auxiliary systems includes preparation of foundation drawings, single line diagrams, installation drawings, electrical layouts, design calculations etc. Design memorandum and other relevant drawings and documents required for engineering of all facilities within the scope to be provided under this contract, are covered under Contractor's scope of work.

#### 3.1. SUPPLIES & ASSOCIATED WORKS

<b>DC SIDE</b>	
	Solar PV Modules
	Modules Mounting Structure (MMS) along with Foundation
	DC Cables including MC4 connectors and DWC pipes
	String Combiner Box
	Power Conditioning unit
<b>AC SIDE</b>	
	LT Switchgear
	HT Switchgear
	Inverter Transformer & Auxiliary Transformer
	LT Cables
	HT Cables
	SCADA & Time Synchronization Equipment
	Instrumentation and Communication cable
	Earthing System
	Lightning Protection System
	Plant Illumination System

	Auxiliary Power Supply System
	Battery and Battery Charger/UPS
	Tie-Transformer
	132 KV Switchyard Bays
	Grid interfacing so as to meet statutory requirements and comply with CERC code.
<b>GENERAL SYSTEMS</b>	
	Weather Monitoring Station
	Fire Detection and protection system
	Module Cleaning system

### 3.2. CIVIL WORKS

The broad scope of work under this package shall include Civil Structural and architectural works related to but not limited to the following areas, System, Structures / Substructures, Buildings and Facilities:

<b>Site Preparation:</b> Site grading including slope protection, ground preparation/ filling/ levelling (if required) of the Identified area and Cutting, clearing and transporting of bushes/ vegetation/ trees etc.
Procurement of construction power and water supply
Construction of Central Monitoring and Control Station (CMCS) with switchgear room, one number.
Construction of Inverter room/Pre - Engineered Building (PEB) as per bidder's proposal.
Design and construction of Internal Roads as per bidder's proposal
Construction of culvert on the existing canal passing through our land boundary for inter-connecting roads as per bidder's proposal. Culverts to be constructed only if the existing infrastructure is not enough to accommodate
<b>Foundation:</b> Requisite foundation and structures wherever required
Design and construction of Drainage system as per General Layout and Topography
Construction of Prestressed precast Boundary wall / Fencing and Main gate as per approved design
<b>Rooms:</b> Construction of Central Monitoring and Control Station (CMCS), Inverter room, Main pooling switchgear, security room, Gate complex
Design and construction of a Module Washing System. Water supply arrangement for washing including supply and installation of Module Washing System
<b>Cable Routing:</b> Requisite cable routing through cable trenches/ trestle and/ or cable tray, Where ever required.



Construction of Store Room, One number.
<b>Roads:</b> Construction of Approach road, service roads
Design and construction of Sewerage System for any facility/ Room /building
Switchyard Civil works.
Civil Foundation for all electrical items/33KV Systems
<b>Fencing/Boundary:</b> Fencing along the periphery of the complete land
Rain water harvesting
Additional civil works

### 3.3. POWER EVACUATION AND TELEMTRY

3.3.1. **Power Evacuation System:** The power evacuation shall be at 132 kV level through 132 kV Line. Bidder' scope shall be up to 132 kV Line Take-off Gantry. All equipment/hardware required for termination at Line take off Gantry including equipment support structure and civil works shall be under scope of bidder. Supply and installation of Metering Panel along with control cable shall be in bidder's scope.

The Bidder or its Sub-Vendor should have designed, constructed/ erected, tested and commissioned one (1) Air Insulated Substation/switchyard of 132 kV or above voltage class having at least four (4) bays which should have been in successful operation for minimum two (2) years prior to the date of award of contract by MAHAPREIT to the Bidder.

*Note: -: For the purpose of qualifying requirement, one no. of bay shall be considered as a bay comprising of atleast one circuit breaker, two disconnectors and single-phase current transformers*

3.3.2. **Telemetry Requirement:** The arrangement to transmit data required by the Load Dispatch Centre (LDC) from solar Plant to MSETCL/MSLDC as per extant regulations and procedures for grid management upto 33/132 kV switchyard control room/CMCS room near Plant Boundary shall be in contractor's scope. Necessary software and Hardware, including laying of Communication/Fibre Optic cable upto Switchyard control room required for communication of plant data from Solar plant SCADA to Load Dispatch Center (LDC) is included in the contractor's scope. Communication link and communication controller/Gateway used for data communication to LDC shall be redundant (one for normal operation and other as hotstandby). Bidders are advised to update themselves with State LDC requirement for compliance related to Automatic Meter Reading (AMR), telemetry data, channel and procedures for engineering of telemetry solution accordingly.

### 3.4. SCADA HMIS /SERVER EQUIPMENT

S. No.	Description	Quantity
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1	Engineering cum Operator work station workstation (EWS+OWS) (Desktop & Monitor)	01 Set
2	Operator work station (OWS) (Desktop & Monitor)	01 Set
3	Portable (laptop based) EWS	01 No
4	Historian (Desktop)	01 No
5	50 Inch LED display	01 No
6	Time Synchronization equipment	01 No
7	Control Desk	1 Set
8	Chairs for Control Desk	04 Nos
9	Laser Printer	01 No

### 3.5. TESTING

During detailed engineering, the contractor shall submit for Owner's approval the reports of all the type tests as listed in this specification. Unless specified, the type test should have conducted within last ten years from the date of bid opening. These reports should be for the test conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client.

However, if the contractor is not able to submit report of the type test(s) conducted within applicable period or in the case of type test report(s) are not found to be meeting the specification requirements, the contractor shall conduct all such tests under this contract at no additional cost to the owner either at third party lab or in presence of client /owner's representative and submit the reports for approval.

All acceptance and routine tests as per the specification and relevant standards shall be carried out. Charges for these shall be deemed to be included in the equipment price.

### 3.6. PAINTING

The bidder's scope of work includes painting of all equipment's and structures as per the Employer's standard colour coding scheme. The painting shall include required application of finish paint indicated elsewhere in the Technical Specification. The quality and finish of paints shall be as per standards of BIS or approved equivalent. Employer's Colour Coding scheme shall be furnished during detailed engineering stage.

### 3.7. TRAINING OF EMPLOYERS PERSONNEL

The bidder shall provide training (free of cost) to the personnel of MAHAPREIT for 15 man-days at his works and at site for erection, testing, commissioning and O&M. Expenses towards travel, lodging, and boarding and other expenses for the personnel shall be borne by MAHAPREIT.

### 3.8. PERFORMANCE GUARANTEE (PG) TEST

The performance guarantee tests shall be carried out as specified elsewhere in the Technical Specification. All special equipment, tools and tackles instruments, measuring devices required for the successful conductance of PG test shall be provided by the bidder, free of cost. All costs associated with the PG tests shall be included in bid price.

Minimum guaranteed generation at metering point by shall be as per separate clause of this chapter. Bidder shall adopt module mounting arrangement with fixed/seasonal tilt/east-west tracking system or combination of any or all of the above as outlined in the specification to achieve the quoted generation.

### 3.9. OPERATION AND MAINTENANCE (O&M)

Comprehensive O&M of the entire facilities located in the solar plant for a period of **five (05)** years from the date of successful completion of trial run is in the scope of the bidder.

## 4. INPUT FOR LIQUIDITY DAMAGE FOR SHORTFALL IN PERFORMANCE DURING PERFORMANCE GUARANTEE TEST AND O&M PERIOD

### 4.1. Solar Insolation at the sites

Month	Solar Insolation (kWhr/m <sup>2</sup> )
January	102.4
February	127.5
March	175.2
April	191.4
May	206.8
June	172.7
July	148.8
August	147.4
September	146
October	142.4
November	116.9
December	108.9
<b>Year Total</b>	<b>1786.4</b>

4.2. Tariff for determination of Liquidated Damages for shortfall in generation during Performance Guarantee Test: PPA Rate with beneficiary (Rs/ kWh) x 10.9256

4.3. Tariff for determination of Liquidated Damages for shortfall in generation during O&M Period: PPA Rate with beneficiary.



## 5. CODES AND STANDARDS

All works shall be carried out as per the standards/codes (IEC, IS etc) referred in the specification. All standards, specifications and codes of practice referred to shall be the latest editions including all applicable official amendments and revisions as on date of opening of bid. In case of conflict between this specification and those codes/standards referred the former shall prevail.

Equipment's complying with other internationally accepted standards such as BS, UL, DIN, VDE etc. will also be considered, if they ensure performance and constructional features equivalent or superior to standards listed in the specification. In such case the Bidder shall clearly indicate the standards adopted, furnish a copy in the English of the latest revisions in force as on date of opening of bid and shall clearly bring out salient features for comparison.

## 6. APPROVALS

The scope of the bidder includes complete design and engineering, technical coordination (including participation and arranging technical coordination meetings), finalization of drawings/ documents, submission of engineering drawing / documents and processing of their approvals by the Employer as per relevant clauses of bid document and other relevant clauses given elsewhere in the Technical Specifications. Further, the scope shall also include submission, in proper shape & format, of all types of manuals, handbooks & documents in requisite numbers to the Employer at different phases of the project as per the requirement of Employer. The contractor shall have to arrange technical coordination meetings and ensure participation.

## 7. TERMINAL POINT

The terminal point under the scope of this assignment shall be termination to 132 kV Line Take-off Gantry. Bidder shall furnish all relevant data required by the employer at interface points within schedule as agreed prior to award of contract.

## 8. SPARES

The Bidder shall include in his scope of supply all the necessary Mandatory spares as described elsewhere in the specifications.

# III. DC SYSTEMS

## 1. SOLAR PHOTOVOLTAIC (SPV) MODULES

The Solar PV module comprises of PV cell(s) connected in any combination to achieve the required module power output. PV cells directly produces DC power on receipt of solar irradiation.

### 1.1. CRYSTALLINE SILICON MODULES (C-Si)

The PV cells in a crystalline silicon module shall be protected by encapsulation



between front glass and back sheet/back glass. The glass shall be made of high transmissivity and front surface shall give high encapsulation gain. The technical details of Solar PV Modules shall be as given below:

Sl. No.	Description	Details
1	Type of SPV Module	Crystalline Silicon
2	Peak Power rating of Module	Shall not be less than 400Wp
3	Module Efficiency	Minimum 15 % at Standard Test Conditions
4	Fill Factor	0.7(Minimum)

### 1.2. CODES AND STANDARDS

The applicable codes and standards are as mentioned below:

Codes	Description
IEC 61215 -2016	Crystalline silicon terrestrial photovoltaic (PV) modules - Design qualification and type approval
IEC 61730 - 1 -2016	Photovoltaic (PV) module safety qualification - Part 1: Requirements for construction
IEC 61730 - 2 -2016	Photovoltaic (PV) module safety qualification - Part 2: Requirements for Testing
IEC 61701 - Edition 2.0 2011-12	Salt mist corrosion testing of photovoltaic (PV) modules
IEC 62804 - 1: 2015	Photovoltaic (PV) modules - Test methods for the detection of potential-induced degradation - Part 1: Crystalline silicon

### 1.3. TECHNICAL REQUIREMENTS

- a) The temperature co-efficient of Power for the module should be better than - 0.45% per deg C. Each and every SPV module shall conform to standards mentioned in 2.2 above and no negative power tolerance shall be accepted. Additionally, the Module wattage band/bin offered shall not be less than 5Wp. Each inverter shall use only one type (Make and Nominal rating) of module.
- b) Module shall be made up of mono or poly-crystalline silicon cells. The module should be PID resistant. The front glass used to make the crystalline silicon modules shall be toughened low iron glass with minimum thickness of 3.2 mm (2.5mm for glass-to-glass module) for 72 cell module. The glass used shall have transmittance of above 90% and with bending less than 0.3% to meet the specifications.
- c) The module shall not be subjected to any point load during transportation,

handling and erection and complete care has to be taken to avoid any undue loading on either side of the module.

- d) The interconnected cells shall be laminated in vacuum to withstand adverse environmental conditions. The EVA used for the modules should be of UV resistant in nature with gel content of more than 70%. The back sheet used in the crystalline silicon-based modules shall be of 3 layered structures. The thickness of back sheet should be of minimum 300 microns with water vapour transmission rate less than 2.0g/m<sup>2</sup>/day (38°C at 90% RH). The Back sheet can be fluoropolymer based or of any other well proven technology details of which shall be submitted and reviewed during detailed engineering and shall be subject to Employer's approval. The backsheet shall have globally benchmarked durability properties on Moisture barrier, Tensile Strength (Machine Direction & Transverse Direction), Elongation retention and UV stability and shall be able to withstand system voltage. In case of glass-to-glass module, the back glass shall have a minimum thickness of 2.5mm.
- e) The module frame shall be made of corrosion resistant materials, preferably having aluminum anodized finish. The anodizing thickness shall be 15 microns or better. In case the offered module is frameless, suitable retaining clips/clamps used for installing the modules shall not damage the glass surface in contact with the retaining clamp
- f) Module(s) shall be provided with minimum three (03) bypass diode.
- g) Junction box(es) of the module should be of high-quality IP 65 or better rated fitted at the back side which should be weather proof and designed to be used with standard wiring or conduit connection. Each Junction Box shall contain Bypass Diode.
- h) It is to be ensured that the Modules installed on a MMS Table, in two rows, should be connected to each other so as to minimize the shading effect. The same is to be achieved by connecting the modules (generally 20 in number) in the upper row of two consecutive tables in series. Similarly, the modules in the lower row are to be connected in series and to be kept separate from the modules in the upper row.
- i) SPV module shall perform satisfactorily with ambient temperatures between - 10°C & +60°C and shall withstand gust up to 150 Km/h on the surface of the panel.
- j) Solar PV modules used in solar power plants/ systems must be warranted for the product Workmanship (process and materials) for a period of minimum 10 years. Further, they shall also be warranted for their output peak output peak watt capacity, which should not be less than 90% at the end of 10 years and 80% at the end of 25 years from the completion of the trial run.
- k) The bidder shall provide the sample solar PV module electrical characteristics including current-voltage (I-V) performance curves and temperature coefficients

of power, voltage and current.

- l) The minimum design clearance (at the highest tilt angle) between the lower edge of the modules and the developed ground level shall be 400 mm. A tolerance of +/-50mm shall be allowed as per site conditions
- m) Each PV module deployed must use a Radio Frequency identification (RFID) tag for traceability. RFID shall either be placed behind name plate sticker or behind bar code label pasted on the back glass of PV module and must be able to withstand harsh environmental conditions during the module lifetime. One number RFID reader has to be supplied by the bidder which has to be compatible to read the data from the RFID Tag & download the data to Computer. All associated Software & Cables are to be provided along with the RFID reader. The following information must be mentioned in the RFID used on each module.
  - 1. Name of the manufacturer – PV Module
  - 2. Month & year of the manufacture of the module
  - 3. Country of origin
  - 4. I-V curve for the module
  - 5. Wattage,  $I_m$ ,  $V_m$  and FF for the module
  - 6. Unique Serial No. and Model No. of the module
  - 7. Date and year of obtaining IEC PV module qualification certificate
  - 8. Name of the test lab issuing IEC certificate
  - 9. Other relevant information on traceability of solar cells and modules as per ISO 9001
- n) All the modules in the PV plant should be arranged in a way so as to minimize the mismatch losses.
- o) Each module should have two suitably sized stranded UV resistant cables and terminated with DC plug-in connector directly. The positive (+) terminal has a male connector while the negative (-) terminal has a female connector. The connectors used for interconnecting the modules and connectors used for connecting the strings and/or to the String combiner Box, i.e. field connectors shall be of same make for better compatibility (refer Connectors chapter elsewhere for detailed Specification of Field Connectors). In case, 1500 V modules are used, the connecting cable shall be as per the relevant standard.
- p) The bidder has to submit, along with the data sheet of the module, a detailed Bill of Material (BoM) elaborating on the properties, such as, thickness, material composition etc of the major components of the module which shall be same as per the type tested and approved Constructional Data Form (CDF).

#### 1.4. NAME PLATE

All individual modules shall be provided with Name Plate label at the back of module which shall provide the information given below for identification. They shall be clearly visible and shall not be hidden by equipment wiring. Type of labels and fixing of labels

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shall be such that they are not likely to peel off/ fall off during the life of the panel.

1. Manufacturer's Name
2. Model Number, Serial Number
3. Overall Dimensions (W x L x D)
4. Weight (kg)
5. Maximum Power (P<sub>MAX</sub>), Voltage (V<sub>MP</sub>), Current (I<sub>MP</sub>)
6. Short Circuit Current (I<sub>SC</sub>), Open Circuit Voltage (V<sub>OC</sub>)
7. Main System Voltage
8. Relevant standards, Certification lab. name
9. MAHAPREIT Logo on the top corner of each Module (Design shall be provided to successful bidder during detail engineering)
10. Warnings, if any

#### 1.5. TYPE TEST

SPV modules must be tested and certified by any of the accredited certifying agencies according to above mentioned International Standards at clause 2.0 above and the type test reports shall be submitted for approval.

**Note:**

*The Module Manufacturer, along with the Module datasheet, shall also provide the Details about the PV Cells used for the offered PV Modules. The information shall contain Cell Source, Type, and Electrical Parameters including efficiency, Size, Number of Bus bars and any other relevant information. (For Crystalline Silicon Modules)*

*In case the successful bidder supplies PV Modules of different make and/or model or from different agencies, the fixing holes in the frame/ location of retaining clips, their location, diameter, centre-to-centre distance between them and all other attributes related to mounting should be same, if applicable.*

Bidder shall submit **third-party verified** PAN files **for one module in each wattage bin offered** and **self-certified** Electro- Luminescence (EL) Test reports **of all the** PV Modules being offered to MAHAPREIT.

## 2. MODULE MOUNTING STRUCTURE (MMS)

The PV modules shall be mounted on metallic structures called Module Mounting Structures (MMS) having adequate strength and appropriate design, which can withstand the load of the modules and design wind pressure:

## 2.1. CODES AND STANDARDS

The applicable codes and standards are as mentioned below:

1	IS 875: Part 1 & 2	Code of practice for the design loads for buildings and structures-
2	IS 875: Part 3	Code of practice for the design loads for buildings and structures-Wind Loads
3	IS 800: 2007	Code of practice for use of structural steel in general building construction
4	IS-4759	Hot-dip zinc coatings on structural steel and other allied products
5	IS 1868	Anodic Coatings on Aluminium and its Alloys

## 2.2. TECHNICAL REQUIREMENTS

a) Modules shall be mounted on non-corrosive support structures. The Bidder can provide any of the following types of mounting arrangement:

- **Fixed Tilt**
- **Seasonal Tilt-** Mounting arrangement shall have provision to adjust it at two or three angular positions. The angular difference between two consecutive tilt positions shall not be less than 5 degrees.
- Automatic motor powered **Realtime East-West tracking**

The Bidder can also provide, the combination of the two arrangements. However, all modules corresponding to any inverter shall have the similar type of arrangements

- b) Mounting structures shall be designed to withstand the extreme weather conditions in the area. The site design wind speed factors  $k_1$ ,  $k_2$ ,  $k_3$  and  $k_4$  shall conform to IS 875 (Part-3): 2015 for the design of MMS
- c) The structural material, corrosion protection and design, shall be as per Design Criteria for Module Mounting Structures (MMS) described elsewhere in this specification.
- d) The proposed foundation system for MMS shall be as per the geotechnical investigation report.
- e) The design philosophy and the calculations for the MMS and the foundation system shall be submitted for prior approval of MAHAPREIT before the commencement of construction.
- f) Further details related to structures and foundations have been mentioned in the chapter on civil works of this specifications.
- g) In case, String Combiner Box (SCB) shall be mounted on the Module Mounting structures, bidder to take into consideration the load of SCB during the designed of MMS. Further suitable supporting members for mounting the SCB on the MMS shall also be within the scope of the bidder.

- h) Suitable provision of a mechanized arrangement for seasonal tilting of the Module Mounting Structure shall also be provided. The same may be provided using the jacks placed below the MMS at few locations and used for lifting the MMS. The Bidder may also propose alternate mechanized arrangement subject to MAHAPREIT approval.
- i) All bolts of module mounting structure and its foundation shall be immediately tightened upon erection to ensure that no damage happens to the MMS and panels due to heavy winds arising during the erection period.

### 2.3. TRACKING SYSTEM (IF APPLICABLE)

#### 2.3.1. TECHNICAL REQUIREMENTS

- a) Only single axis East-West realtime tracking shall be acceptable.
- b) All modules associated with a specific tracking system should be connected to a common inverter.
- c) Each of the tracking units should have a redundant (2 nos) inclinometers mounted on the structure.
- d) In case of failure of supply, the arrays should return to the stow position. Bidder shall supply a tracking mechanism with an inbuilt feature for meeting the requirement.
- e) The Vendor can provide the backtracking arrangement for best utilization of land. A suitable arrangement/bellows shall be provisioned to protect actuator assembly from extreme outdoor harsh condition, dust and UV rays.
- f) The material of the tracker should be corrosion resistant enough and must last to its full lifespan of 25 years. Minimum coating thickness for corrosion protection shall be as per this specification mentioned in Part-D.
- g) All control and automation hardware shall be of industrial grade with a good performance in ambient air temperature range of (-) 5° to 60° centigrade.
- h) Tracker shall be equipped with safety features like, lightning protection, auto high wind stow and shall have uninterrupted communication with monitoring console/station. It should be capable of sending alarms to the monitoring station in case of failure or abnormal operations of the tracking systems.
- i) Suitable redundancy in sensing and auxiliary power supply shall be provided for fail-safe stowing of trackers. Redundancy in control is also desirable for the safe operation of trackers. VRLA battery shall not be accepted for tracker operation/control. Detail of the scheme for various redundancy shall be finalized at the time of detail engineering.

#### 2.3.2. MODULE MOUNTING ARRANGEMENT

- a) Module mounting structures shall be designed to withstand the extreme weather conditions in the area. The site design wind speed factors k1, k2, k3 and k4 and pressure coefficient shall conform to IS 875 (Part-3): 2015 or as per a Wind Tunnel Study from a reputed national/international facility, for the design of MMS.

If the Bidder is going for wind tunnel test for the design and analysis of complete MMS and solar tracking system following has to be ensured

- i. It must be done from an institute of reputed (IITs in India).
  - ii. If the test is done by any reputed international facility the test results must be vetted by any of the IITs in India.
  - iii. Bidders must ensure that offered tracker has proven design with wind tunnel test simulating actual site conditions. The design, analysis and its vetting shall be completed within two months from the actual date of issue of LOA.
  - iv. Test results and design must comply with Indian codes
  - v. The design shall be shown in STAAD pro for further checking of MAHAPREIT if asked to do so.
- b) The structural material, corrosion protection and design, shall be as per Design Criteria for Module Mounting Structures (MMS) described elsewhere in this specification.
  - c) The design and the calculations for the MMS and the foundation system shall be submitted for prior approval of MAHAPREIT before the commencement of construction and shall be based on the soil report.
  - d) Further details related to structures and foundations have been mentioned in the chapter on civil works of these specifications.
  - e) The Structure shall be designed and analyzed in accordance with finite element method using software (STAAD pro), with considering Dead load and wind load as per IS: 875 (Part 1& 3) or as per Wind Tunnel study done from a reputed national/international facility respectively. Analysis to be done as per appropriate load combinations preferably as per IS codes.
  - f) The Structure must be provided with limit switches to control the rotation of the frame.
  - g) All nuts and bolts shall be of SS type for a module to structure connection and other structural bolts shall be of grade HDG 5.6 or 8.8 according to the connection design requirement.

### **2.3.3. BEARING**

- a) The bearing should be type tested for operation cycles which solar plant will go through in its life of 25 years.
- b) Preferably there should not be any lubrication in the bearing, but if there is any, then it should be maintenance free. No cleaning should be needed.
- c) The bearing should also be resistant to dust, water and any other external parameters.

### **2.3.4. MOTOR AND ACTUATOR**

- a) The motor should be IP 65 or better and it should be powered by reliable supply to drive the link through gear or hydraulic/electric actuator.



- b) The temperature rises in the motor during operation specified in IS12802: 1989 should not be more than approximately 10°C.
- c) The location and moisture or fumes shall not seriously interfere with the operation of the motor.
- d) The severity of vibration for the motors shall be within the limits specified in IS 12075: 1987.

#### **2.3.5. CONTROLLERS**

- a) Trackers should have an industrial grade system for its automatic control and operations. For all outdoor controllers, it should be housed in IP-65 enclosure.
- b) Battery back-up should be provided for Controller and motor for at least 15 minutes with power pack cum UPS. Alternatively, the bidder can provide backup power from the UPS of inverter room or CMCS room.
- c) The controller must be enabled with a feature of stowing during high-speed winds.
- d) The Real Time Clock (RTC) of the trackers shall have a facility to be time synchronized with SCADA on Network Time Protocol (NTP).
- e) A suitable communication link between the controller and tracker SCADA system shall be arranged. The software for communication and analysis shall be provided by the tracker supplier. Tracker SCADA shall be interfaced with solar SCADA on an open protocol such as MODBUS.

### **3. DC CABLES**

The DC Cables in a solar PV plant are used in the following areas

- I. Interconnecting SPV modules
- II. From SPV Modules upto SCB
- III. From SMU upto the Inverter

#### **3.1. DC CABLES (Interconnecting SPV MODULES and from SPV Modules TO SCB)**

- a) Cables used for inter-connecting SPV modules as well as Modules to SMU's shall conform to the requirements of **EN 50618:2014** applicable for DC cable for photovoltaic system.
- b) This shall be applicable for both 1000V and 1500V modules.
- c) These cables shall also meet the fire resistance requirement as per the above standard and shall be electron beam cured.
- d) All cables except module cable used for (+) ve and (-)ve shall have distinct color identification.
- e) In addition to manufacturer's identification on cables as per EN50618, following marking shall also be provided over outer sheath
  - i. Cable size and voltage grade
  - ii. Word 'FRNC' at every 5 metre





- iii. Sequential marking of length of the cable in metres at everyone metre
- f) The Printing shall be progressive, automatic, in line and marking shall be legible and indelible.
- g) Type test, routine, acceptance tests requirements for these cables shall be as per EN50618:2014. All test charges shall be deemed to be included in the cable price. Sampling for acceptance tests will be as per IS 7098.
- h) A maximum of 8 Cables (4 Circuits) shall be laid in one HDPE Pipe for DC Cable from Module to SMB. The fill factor of the pipe should not be more than 40%. However, in case of necessity to lay more than 8 cables (4 circuits) in one pipe, the same shall be allowed during detailed engineering and as per the derating factors recommended by the cable manufacturer. Fill factor criterion is still to be maintained. Bidder to ensure that there is no gap and proper packing at the junction of two pipes, in which DC cable is laid, using proper method and accessories, like bell mouth.

### **3.2. DC CABLES (STRING COMBINER BOX TO INVERTER)**

Cables used between SMU's and Inverters shall be of min. 1.5 kV (DC) grade. In case bidder offers 1500V DC system 3.3 kV (E) grade cables shall be provided. These Power cables shall have compacted Aluminium/copper conductor, XLPEinsulated, PVC inner-sheathed (as applicable), Armoured/Unarmoured, FRLS PVC outer sheathed conforming to IS: 7098 (Part-I). These cables shall confirm to the requirements of the standards & codes specified at clause 1.0 of Chapter- LT Cables or any other relevant standard elsewhere in the specification.

All the requirement specified for LT POWER CABLES under clause 2.0, 4.0 & 6.0 of Chapter-LT Cables shall also be applicable to these cables.

### **3.3. DC CABLES SIZING CRITERIA**

The **Maximum Overall Voltage Drop** from **Module to Inverter Transformer** shall be limited **to 3% of rated voltage**.

### **3.4. CABLE DRUM**

For details refer clause 10.0 of Chapter -LT Cables.

## **4. STRING COMBINER BOX**

String Combiner Box (SCB) is used in multi-string photovoltaic systems to combine the individual strings electrically and connect them to the Inverters. It shall have protection devices to protect the PV modules from current/voltage surges. Nos. Input to each SCB



shall be decided during detail engineering based on the approved Single Line Diagram (SLD) submitted by contractor.

Vendor to note that DC system of both 1000 V- and 1500-Volt rating is accepted based on solar string/array design offered by contractor. Accordingly, component/assembly shall comply with 1000/1500 V rating as applicable.

Voltage rating of the selected component shall be 1000V or 1500V (Min.) as per system requirement during detail engineering.

SCB offered for 1500V application should have been already type tested and if type test reports are not available, for meeting the project schedule, Bidder/Sub-vendor shall take suitable steps quite in advance to ensure successful conduction of tests within two months from date of LOA.

#### 4.1. CODES AND STANDARDS

SL NO.	CODES	DESCRIPTION
1.	UL 94 V	Fire Resistant/ flammability for Enclosure
2.	UL 746C	UV Resistant for Enclosure
3.	IEC 62262/EN 50102	Mechanical Impact Resistance for Enclosure
4.	IS 2147/IEC 60529	Degrees of protection provided by enclosures (IP Code)
5.	IEC 61643-12	Surge Protection
6.	IEC 62208	Enclosure for low voltage Switchgear and control gear assemblies

Vendor shall submit the suitable Test Certificate/Report from accredited lab(s) indicating compliance of mentioned codes and standard if asked for the offered component or assembly.

#### 4.2. GENERAL REQUIREMENT

SCB shall be equipped (but not limited to) with the following:

- i. DC Disconnecter /Breaker to disconnect the PV strings from the Inverter for maintenance purpose as per specification mentioned in this chapter.
- ii. All component in the SCB shall be suitable for operation within temperature range of 0-70 Deg C.
- iii. Fuse in each SCB input (both positive and negative) shall be provided to prevent the reverse short circuit current flow. However, in case of negative string fuse is not required as per recommendation of inverter manufacturer, string cable shall preferably be terminated with field connector with SCB.
- iv. Surge Protection Devices for protection against surge currents and voltages as per specification given in separate clause. Other associated items like cable glands, lugs, Vents and items required for the protection and completeness



- of the system shall be provided
- v. The common collection bus bars should be made up of zinc/tincoated copper and shall be suitably sized to limit temperature rise within safe operating limits.
  - vi. Vendor shall ensure adequate clearance with suitable insulated separator between positive bus and negative bus if it is in same enclosure. Positive and Negative section shall be orientated horizontally (Landscape orientation) on the either side of separator. Separate compartment for negative section and positive section for termination of positive and negative string input shall be preferred.

#### 4.3. DC SURGE PROTECTION DEVICES (SPD) for PV Solar Application

DC output SPD shall consist of three Metal Oxide Varistors (MOV) type surge arrestors which shall be connected from positive and negative bus to earth. The discharge capability of the SPD shall be at least 12.5kA at 8/20 micro second wave as per IEC 61643-12 and shall be rated for MCOV 1000/1500 Volt DC. During fault and failure of MOV, the SPD shall safely disconnect the healthy system. SPD shall have thermal disconnecter to interrupt the surge current arising from internal and external faults. In order to avoid the fire hazard due to possible DC arcing in the SPD due to operation of thermal disconnecter, the SPD shall be able to extinguish the arc. SPD shall have local visual indication and potential free contact for remote indication.

#### 4.4. STRING FUSES

In order to provide protection to all cables and modules, string fuses shall be provided with strings. String fuses shall be of PV category and dedicated to solar applications and conform to IEC 60269-6 or UL-2579 standards and fuse base shall comply to IEC 60269-1. String fuses should be so designed that it should protect the modules from reverse current overload. Fuses or Isolation Link shall be mounted in pull out type fuse holders. Fuse holders shall be suitable for DIN rail mounting. PCB mounted fuses are not acceptable. Fuse rating for single and combined input (limited to two) shall be 15 A and 30 A respectively suitable for 1000/1500 Volt for crystalline module. For Thin film modules, fuse rating shall be decided during detail engineering. In case of negative grounded system, string fuse as well as inverter input fuses on negative side shall be based on Inverter manufacturer's recommendation.

#### 4.5. SCB ENCLOSURE

SCB Enclosure shall satisfy the following requirement.

The enclosure shall be made of fire-retardant material with self- extinguishing property and free from Halogen, UV Protected. Material of the enclosure shall be made of GRP/FRP/Polycarbonate.

- i. Degree of protection for enclosure shall be at least IP 65. All the part shall



be corrosion resistant and enclosure surface shall be free from crazing, blistering, wrinkling, color blots/striations. There should not be any mending or repair of surface. Complete assembly shall be erected below suitable canopy/ rain cover or Modules at site.

- ii. The mechanical impact resistance of enclosure shall be IK 07 or better.
- iii. The size of the enclosure and general arrangement of the component shall be designed in such a way that the temperature rise of at any point of enclosure shall not rise more than 12 deg C above the ambient temp of 55 deg C. The components mounted inside the SCB shall have higher temperature withstand capability and shall continuously operate under such conditions.
- iv. Complete assembled SCB shall be subject to heat run type test to be witnessed by owner after manufacturing. In case it is found that the temperature rise is beyond the acceptable limits, bidder shall redesign the assembly and perform the test free of cost to verify that temp. rise is within acceptable limit.
- v. In each SCB 5% spare terminals along with cable glands and fuse rounded off to next higher integer shall be provided to connect the PV strings.
- vi. All terminals' blocks shall be rated for min 1000V/1500 V and rated continuously to carry maximum expected current.
- vii. In case, SCB is proposed to be mounted on the MMS structure, the additional load of the SCB shall be considered for the design of structure. If the SCB is proposed to be mounted on separate structure and is not protected from top, suitable canopy shall be provided on top of SCB extending minimum 50mm from all four sides. Design and dimensions of SCB structure must be such that minimum 600 mm of ground clearance is ensured at site for repair and maintenance. Drawing of such structure with mounting arrangement of SCB shall be submitted to MAHAPREIT for approval during detail engineering. All the erection hardware and mounting accessories shall be galvanized steel.
- viii. All internal wiring shall be carried out with stranded copper wires with voltage rating mentioned elsewhere in the specification. All internal wiring shall be securely supported, neatly arranged readily accessible and connected to component terminals and terminal blocks. Wire terminations shall be made with solder less crimping type of tinned copper lugs which firmly grip the conductor and insulation. Insulated sleeves shall be provided at all the wire terminations. Engraved core identification plastic ferrules marked to correspond with the wiring diagram shall be fitted at both ends of each wire. Ferrules shall fit tightly on wires shall not fall off when the wire is disconnected from terminal blocks.
- ix. If metallic hinge is being used with enclosure cover, it shall be made of SS 304 and shall be rust proof. Enclosure shall be provided with captive screws so that it screw don't fall off when cover is opened. Screw shall be made of corrosion free material. Suitable non- conducting protection cover shall be provided for any metallic hinge/screw/fastener to avoid contact with live part of the



assembly.

- x. Mounting plate inside the SCB for mounting/fixing of devices shall be made of FRP/GRP or equivalent non-conducting material.
- xi. Offered enclosure shall have adequate space to fix one String Monitoring card, One Modbus SPD and One DC-DC converter for internal power supply with suitable terminal block for retrofitting of enclosure to convert the offered combiner box as String Monitoring Box in future by MAHAPREIT. Vendor shall submit a sample Internal GA drawing with aforementioned components for future use of MAHAPREIT in addition to the drawing/document(s) for inspection and dispatch of offered assembly for MAHAPREIT approval.

#### 4.6. DC ON-LOAD ISOLATOR

Solar PV on-load Isolator shall be suitable for minimum 1000Vdc or 1500 Vdc operational voltage, with minimum 250Vdc per pole breaking. 2. Any multipolar device achieving this configuration with Shorting links will not be acceptable.

Air Insulation distance shall be higher than 25 mm and the creepage distance shall be higher than 50 mm. The PV Isolators shall be type tested to carry the nominal current till Min. ambient temperature of 60 Deg C without any de-ration inside the String Junction box. Switching part shall necessarily contain reinforced break chamber, with an integrated magnetic arc-extinguishing system for the PV arc. Isolator terminals need to be Silver plated. The Solar PV Isolators need to have a positive break indication and will have to comply with IEC 60947-3 and PV-2 for critical current.

#### 4.7. TYPE TEST

Vendor shall submit the following Type Test/ Product Certification from any National/International accredited lab for approval:

- i. Temperature rise test on complete assembled Box as per acceptable limit mentioned in relevant clause.
- ii. Type test for enclosure as per code and standard mentioned in relevant clause.
- iii. Thermal ageing at 70 Deg C for 96 hours as per IEC 60068-2
- ii. HV Test

#### 4.8. DC PLUG-IN CONNECTORS FOR FIELD CABLING

4.8.1. Field connectors are electrical connectors/coupler used for connecting solar panels and also strings of panels to String combiners box. Cable connector to be used for connecting SPV modules and String monitoring boxes shall be In accordance with IEC 62852: 2014.



Connector shall be of plug and socket design to be plugged together by hand but can be separated again using a tool only. Contractor shall ensure that field connectors to be mated shall always be of same make and model or shall be tested Inter-compatible as per clause no.6.3.11 of IEC 62852: 2014 for offered make(s).

Mating of connectors of different makes/model shall not be acceptable if not tested for inter-compatibility by any accredited lab.

#### 4.8.2. TECHNICAL REQUIREMENTS

Rated Current	30 A (4 MM <sup>2</sup> , 6 MM <sup>2</sup> ) - 40 A(10 MM <sup>2</sup> )
Rated Voltage	Min1000/1500 Volts as per system requirement
Connector Design	Snap-In locking Type
Protection Degree	IP68 (Mated)
Ambient Temperature	(-) 40 <sup>0</sup> C to (+) 85 <sup>0</sup> C
Protection/Safety Class	Class II
Contact material	Cu
Contact surface material	Silver/Tin
Contact resistance for plug connector	≤ 0.5 milli-ohms
Stripping length	10mm
In flammability class acc.to	UL 94-V0
Insulating Material	PPE / PPO/Polyamide
Pollution Degree	3
Certification	UL/TUV/CSA/EAC or Equivalent

#### 4.8.3. TYPE TEST FOR DC PLUG-IN CONNECTORS

- i. Protection Degree (IP)
- ii. Operating Temperature
- iii. Inflammability
- iv. Pollution Degree
- v. Voltage Withstand (Rated Voltage/Test Voltage)
- vi. Product Certification

## 5. POWER CONDITIONING UNIT

The Power Conditioning Unit (PCU) is Solar Inverter designed to convert solar PV DC power to 3-phase AC power and fed into utility grid. The PCU shall consist of solid-state electronic switch along with all associated control & protection, filtering, measuring instruments and data logging devices. The PCU shall have suitable maximum power

point tracker (MPPT) for operating the input PV Array at its maximum power point. The PCU output shall always follow the grid voltage & frequency by sensing the grid voltage and phase and the PCU shall always remain synchronized with the grid. The PCU shall use only self-commutated device which shall be adequately rated.

### 5.1. CODES AND STANDARDS

The PCU shall conform to all applicable IEC standard. Where an applicable IEC standard is not available, IS/ any applicable international standard shall be referred to as best practice.

IEC-61683	Energy efficiency requirements
IEC 61000	Emission/ Immunity requirement
IEEE 519	Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems.
IEC 60068	Environmental Testing
IEC 62116	Testing procedure—Islanding prevention measures for power conditioners used in grid-connected photovoltaic (PV) power generation systems
IEC 62109-1 & 2	Safety of power converters for use in photovoltaic power systems
EN 50530	Overall efficiency of grid connected photovoltaic inverters
BDEW 2008	Technical Guidelines for Generating plant connected to Medium voltage network
IEEE 1547	Standard for interconnecting distributed resources with electrical power systems.
IEC 60529	Ingress protection test
Grid Connectivity	Relevant CEA Regulations (including LVRT/HVRT compliance) and Grid Code as amended and revised from time to time.

### 5.2. GENERAL REQUIREMENTS

- a) The minimum euro efficiency of the PCU as per IEC 61683 shall be 97%. The bidder shall specify the conversion efficiency at following load conditions i.e., 25%, 50%, 75% and 100% during detail engineering, which shall be confirmed by type test reports.
- b) The PCU shall remain connected to the grid as per Central Electricity Authority Technical (standards for connectivity to the grid) regulation 2007 with all latest amendments and its components shall be designed accordingly.
- c) In case auxiliary supply of PCU is met internally, then it should have sufficient power backup to meet the LVRT requirement. Bidder needs to submit the detail auxiliary supply arrangement for PCU during detail engineering stage.
- d) The PCU shall be capable of operating in the frequency range of 47.5 Hz to 52 Hz and shall be able to deliver rated output in the frequency range of 49.5 Hz to

50.5 Hz.

- e) The monitoring/measurement of DC inputs (central inverter) and AC output shall be done using transducers/instruments having sensor accuracy of 0.5 class or better.
- f) Internal Surge Protection Device (SPD) shall be provided in the PCU on DC and AC side. It shall consist of Metal Oxide Varistor (MOV) type arrestors. The discharge capability of the SPD shall be at least 12.5kA at 8/20 micro second wave as per IEC 61643-12.
- g) The PCU shall be capable of supplying reactive power as per grid requirement (manual intervention through SCADA) during solar generation hours. However, reactive power support, below 0.95 power factor, might be at the behest of active power.
- h) The PCU shall have protection against any sustained fault in the feeder line and against lightning discharge in the feeder line.
- i) The Contractor shall ensure by carrying out all necessary studies that the PCU will not excite any resonant conditions in the system that may result in the islanded operation of PV plant and loss of generation. In case there is excitation of any resonant condition in the system during PV plant operation that may result in the islanding/tripping of the PV plant and affect the power transfer, it shall be the responsibility of contractor to rectify the design and carryout required modification in the equipment of his supply.
- j) The PCU must be self-managing and stable in operation.
- k) In case of grid failure, the PCU shall be re-synchronized with grid after revival of power supply. Bidder to furnish the time taken by PCU to be re-synchronized after restoration of grid supply during detailed engineering.
- l) 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.
- m) PCU shall have active power limit control, reactive power and power factor control feature. Plant operator shall be able to provide (manual intervention) Active power, reactive power and power factor control/limit set point through SCADA HMI and local control display unit (or Laptop computer). PCU shall be provided with remote start and stop facility from SCADA HMI. All required hardware and software required for this purpose shall be provided by Bidder.
- n) PCU shall have necessary limiters in build in the controller so as to ensure safe operation of the PCU within the designed operational parameters.



- o) PCU shall have thermal overloading protection to prevent failure of switching devices (i.e. IGBT) and other components of Inverter. PCU controller shall automatically regulate/limit the power output in order to reduce the PCU cabinet and switching devices temperature. Bidder to submit the PCU power vs ambient temperature curve during details engineering stage. PCU shall be able to provide inverter inside cabinet and IGBT's (switching device) temperature (in soft analog value) to SCADA system for remote monitoring, storing and report generation purpose.
- p) PCU shall have the following feature,
  - a. AC & DC overcurrent protection.
  - b. Synchronization loss protection.
  - c. Over temperature protection.
  - d. DC & AC under and over voltage protection.
  - e. Under & over frequency protection.
  - f. Cooling system failure protection
  - g. PV array ground fault monitoring & detection
  - h. PV array insulation monitoring
  - i. LVRT protection
  - j. Anti-islanding protection
  - k. Grid monitoring
- q) One number of laptop PC shall be supplied for PCU configuration and troubleshooting purpose. Laptop shall be supplied with complete set of hardware & software accessories. Laptop detailed configuration must ensure suitability for the required applications. Supplied Laptop shall be protected with the latest anti-virus software and shall be provided 3 Years onsite warranty including its battery. At least two sets of communication cable for Laptop to PCU communication shall be provided.
- r) PCU shall be provided with Mobile user interface facility for monitoring of inverter by plant O&M personal for better O&M and highest yield from the PV plant. In case PCU does not have this facility, then Bidder can provide the same facility through plant SCADA system.
- s) PCU shall have AC and DC side monitoring capability and reporting to SCADA system (measured analog and digital value measured within PCU). Any special software if required for these purposes shall be provided for local and remote monitoring and report generation
- t) **DC Overloading:** - Maximum PCU DC overload loading shall be limited to its design PV Array Power to PCU nominal AC power ratio. Bidder needs to submit all the relevant technical document/test report from PCU manufacturer (OEM) during details engineering stage in support of declared PCU design DC

overloading capacity.

- u) **EARTHING OF INVERTERS:** -The PCU shall be earthed as per manufacturer recommendation. During detail engineering the Bidder needs to submit the details earthing arrangement of PCU and system earth pit requirement during detail engineering stage. The detail specification for panel earthing for safety has been mentioned elsewhere in this specification
- v) **OPERATING MODES OF PCU**
  - a. **Low Power Mode:** - The PCU shall be able to wake-up automatically when PV array open circuit voltage value is equal/more than preset value in the PCU program. Once its start generation the PCU shall automatically enter maximum power mode.
  - b. **Maximum Power Point Tracking (MPPT):** - In order to maximize the energy collection from solar PV array, the PCU shall have inbuilt maximum power point tracker (MPPT) controller and same shall be able to operate the PV array at its maximum power point by adjusting output voltage of PV array system according to atmospheric condition. PCU MPPT controller shall ensure that it operates the PV array system at its global maximum power point and it shall not be trapped into PV array local maximum power point during cloudy atmospheric condition. The PCU shall operate within its MPPT operating input DC voltage range (window) and same shall be large enough so that MPPT shall be able to satisfactorily operate the PV modules exposed to the maximum ambient temperature of 50°C or any other condition. In case the solar PV array operating maximum power point voltage falls below (or above) the PCU MPPT operating voltage range, then the PCU controller shall automatically adjust the PCU input voltage so that PCU shall not enter into sleep mode. If the PV array output power falls below the PCU minimum preset power value then PCU shall automatically switch to sleep mode. In case, PV Modules connected to Inverter are in Flickering shading zone of Wind turbines, Suitable MPPT algorithm shall be adopted for those inverters to optimize Energy Yield.
  - c. **Sleep Mode:** - PCU shall automatically go into sleep mode when the output voltage of PV array and/or output power of the inverter falls below a specified limit. During sleep mode the inverter shall disconnect from grid. Inverter shall continuously monitor the output of the PV array and automatically start when the DC voltage rises above a pre-defined level. During evening and night (non solar generation hours) the PCU shall be in sleep mode in order to minimize the internal power loss. Maximum loss in sleep mode shall be less than 0.05% of PCU rated power.
  - d. **Standby Mode:** - In standby mode the PCU DC & AC contactor are open, inverter is powered on condition and waiting for start command.

w) PCU shall meet the following technical parameter

1.	Nominal output voltage frequency	50Hz
2.	Continuous operating frequency range	47.5 Hz to 52 Hz
3.	Continuous operating AC voltage range	± 10% rated AC voltage
4.	Operating power factor range	Operating power factor (adjustable) shall be 0.9 Lead to 0.9 Lag.
5.	Maximum input DC voltage	1000V or 1500V as per application requirement.
6.	Current THD value	< 4% at nominal load
7.	Operating ambient temperature	0 to 50 ° C
8.	Humidity	95 % non-condensing
9.	Maximum Noise level (at 1 meter distance)	75 dBA for indoor type PCU
10.	DC Injection	<0.5 % at rated current
11.	Flicker	As per IEC61000

### 5.3. CENTRAL INVERTER

- 5.3.1. PCU must have provision to be isolated from grid through Air Circuit Breakers/MCCB's. The ACBs/MCCBs as required can be provided as a part of PCS/its Modules or separately based on standard design and configuration of PCS manufacturer.
- 5.3.2. PCU shall have suitable rated DC isolator/contactors/MCCB for isolation of PV array from inverter. Suitable rated fuse shall be provided (at inverter end) in incoming DC cable from each string combiner box (SCB). Fuse requirement (at inverter end) in the negative side of incoming DC cable shall be as per inverter manufacturer's recommendation. In case fuse are not recommended by the inverter manufacturer, then suitable rated link in place of fuse shall be provided in the negative side of incoming DC cables from each string combiner box (SCB). One set spare terminal with fuse/link (as applicable) and holder shall be provided for the future use.
- 5.3.3. String Monitoring facility: - PCU shall be provided with current monitoring transducer at incoming DC cables from each string combiner box (SCB) for PV array zone monitoring purpose. The current transducers used for this purpose shall have accuracy of 0.5 class or better. The PCU shall be able to provide the measured DC current value and calculated DC power and energy value of incoming SCB DC cable to SCADA system for remote monitoring, storing and report generation. In case PCU does not have the facility/capability for power and energy calculation within its controller, then Bidder can provide the same facility in SCADA system.
- 5.3.4. The PCU should be designed for parallel operation through galvanic isolation.

Solid state electronic devices shall be protected to ensure smooth functioning as well as ensure long life of the inverter. Parallel operated PCU system are also accepted subjected to recommendation of PCU manufacturer. In such case, PCU design shall also ensure that no abnormal interaction shall take place among the PCU unit during any grid operating condition which may result in outages.

- 5.3.5. Local Display unit for viewing important parameters, configuration and troubleshooting purpose shall be provided. Display shall include all important parameter such as DC input voltage, DC input current, AC output voltage, AC output current, AC output power, frequency etc. Inverter shall also be provided with required software along with accessories (2 sets) for interface with Laptop PC for viewing, configuration, troubleshooting purpose.
- 5.3.6. PCU shall have suitable communication card (Modbus/Ethernet) for networking and SCADA integration. Communication port shall be preferably TCP/IP protocol. PCU shall include all important measured & internal calculated analog values and alarm & trip signals for remote monitoring, storing and report generation purpose in SCADA system. Details list of above such parameters shall be provided along with their Modbus address during detail engineering stage.
- 5.3.7. In case of modular design of PCU is offered, the Contractor shall ensure that no abnormal interaction shall take place among the various PCU modules during any grid operating condition which may result in outages. The PCU controller offered by the Contractor shall be such as to ensure stability, reliability and a good dynamic performance. The Bidder shall indicate the control scheme adopted for modular PCU and its merits and the test which will check its performance.
- 5.3.8. Bidder may offer liquid cooling system subject to MAHAPREIT approval. In case Liquid cooled inverters are offered, Bidder to ensure that coolant is used in closed cycle. Complete inverter along with cooling system shall be of proven design.
- 5.3.9. The Inverter shall have suitable arrangement for negative grounding of solar PV array system and the ground current shall be limited to safe limit. Ground current shall be measured continuously and alarm shall be generated in case ground current reaches to predefined set value. Inverter shall trip in case ground current more than safe operating limit.
- 5.3.10. Inverter shall have emergency stop push button for tripping of inverter with complete DC & AC electric isolation.

**5.3.11. INDOOR CENTRL INVERTER**

- a) The PCU enclosure protection class shall be IP 20 or better protection.
- b) COOLING AND VENTILATION: - To prevent the maximum permissible temperature in the inverter room from being exceeded because of internal heat emission of inverters and other auxiliaries in the inverter room, the inverter room in the PV plant shall be adequately ventilated. Ventilation

shall be designed such that the temperature rise of the inverter rooms doesn't exceed 3 deg above ambient (during 50°C). Filter banks at the air inlet of the inverter room shall be provided to prevent dust ingress. The air velocity through the filter shall be taken at max 1.5 m/sec and the filter shall be chosen accordingly to pass the required intake air through the filter to remove heat from the inverter room. Bidder shall furnish peak power consumption of cooling system (cooling fans, pumps etc.) of the PCU along with the data sheet.

Ventilation shall be designed in such a way that the temperature rise of the inverter rooms doesn't exceed the maximum designed temperature of Inverters and other auxiliary equipment's placed inside the inverter room. Accordingly, the air velocity through the filter shall be suitably chosen to remove the heat from the inverter room. All exhaust and fresh air fans shall be provided with thermostat control.

#### **5.3.12. OUTDOOR CENTRL INVERTER**

- i. Outdoor PCU (including containerised solution) with metallic enclosure are acceptable. The enclosure must be suitable to withstand the harsh environmental conditions for complete life of plant.
- ii. The PCU enclosure protection class shall be IP 54 or better protection.
- iii. Bidder to submit temperature endurance test report of complete assembly during detail engineering stage.
- iv. For Outdoor PCU (without containerised solution) the complete assembly should be placed inside a shed made of structural steel section preferably tubular/hollow section and colour coated metal sheets for roof with BMT 0.5 mm and at least 60cm projection in all side. For containerized solution separate shed is not required, however, the container shall have projection of atleast 60cm wherever an opening in the inverter door exposes the inverter component to outside environment. Structural steel and paints for shed shall be as per ISO 12944-5.
- v. Alternatively, Bidder can also provide integrated protection to the inverter enclosure through suitable other arrangement (s) subjected to MAHAPREIT approval

#### **5.4. STRING INVERTER**

- a) The string inverter enclosure protection class shall be IP 65 or better protection.
- b) The string inverter should be placed inside a canopy shed with atleast 15 cm in all direction, if installed in open. Alternatively, the Bidder can also install the inverter on the column post of the module mounting structure, below the modules. In such case, the canopy is not required and the column and foundation shall be designed accordingly.
- c) String inverter shall have suitable communication port (RS485/TCP-IP/PLC) for SCADA integration. All necessary hardware, software and accessories used for



communication with SCADA (including Data logger if supplied) at both the ends shall be provided by the bidder.

- d) String inverter shall have individual string monitoring capability and reporting to SCADA system. Any special software if required for these purposes shall be provided for local and remote monitoring and report generation.
- e) Anti-PID device along with all hardware and communication cable/device shall be provided in case negative grounding of PV string provision is not available in string inverter. Data logger used in Anti-PID device shall be integrated with SCADA system.
- f) DC fuse requirement for PV string at string inverter end shall be as per string manufacturer/system requirement and same shall be finalized during detail engineering stage.
- g) Provision for AC and DC electrical isolation device (such as MCB/MCCB/Isolator) inside string shall be as per string inverter manufacturer practice.
- h) Local Display unit for viewing important parameters, configuration and troubleshooting purpose shall be provided as per string inverter manufacture practice. In case standard design of string inverter does not include display, then string inverter shall be provided with required software along with accessories (5 sets) for interface with inverter or facility for mobile viewing and configuration with laptop.
- i) LT Junction box, switchboard and switchgear requirement for string inverter system as per chapter C-1 (LT Switchgear).

#### 5.5. TYPE TESTING

- i. Applicable both for Central and String Inverter
- ii. During detailed engineering, the contractor shall submit all the type test reports including temperature rise test and surge withstand test carried out within last ten years from the date of techno-commercial bid opening for Owner's approval. These reports should be for the test conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client.
- iii. However, if the contractor is not able to submit report of the type test(s) conducted within last ten years from the date of techno-commercial bid opening, or in the case of type test report(s) are not found to be meeting the specification requirements, the contractor shall conduct all such tests under this contract at no additional cost to the owner either at third party lab or in presence of client/owner's representative and submit the reports for approval.

#### IV. AC SYSTEMS

##### 1. LT SWITCHGEAR

The design, materials, and method of LT switchgear shall conform to the applicable IEC standard. All equipment shall be installed and all work shall be carried out in accordance with relevant IEC standards. Where an applicable IEC standard is not available, IS/ any applicable international standard shall be referred to as best practice. All standards, specifications and codes of practice shall be the latest editions including all applicable official amendments and revisions.

As a minimum requirement, the following standards shall be complied with:

IS	Details
IEC60947/IS13947	Low-voltage switchgear and control gear
IS 2705	Current Transformers
IS 3043	Code of practice for earthing.
IS 3072	Code of practice for installation and maintenance of Switchgear
IS 3156	Voltage Transformers
IS 3202	Code of practice for climate proofing of electrical equipment.
IS 3231	Electrical relays for power system protection.
IS13703/IEC 60269	HRC Cartridge fuses
IS10118 (4 parts)	Code of practice for selection, installation and maintenance of switchgear and control gear.
IEC 60255	Electrical Relays

##### 6.1. TECHNICAL PARAMETERS

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

<b>B.BUS BARS</b>		
(vi)	Continuous current rating at 50°C ambient:	As Per Requirement
(vii)	Temperature Rise allowed above ambient	40 <sup>0</sup> C for plain joints 55 <sup>0</sup> C for Silver plated joints
<b>B. MCCB</b>		
(i)	Rated voltage	415V
(ii)	Rated Insulation Level	690V
(iii)	Rated ultimate and service SC breaking capacity (As per system requirement)	As per system fault current (for 1sec)
(iv)	Rated making capacity	2.1 times of System fault current
(v)	Utilization category	A
<b>C. DIGITAL MFM</b>		
(i)	Accuracy class	0.5
(ii)	MFM shall be provided at LT incomer feeder. MFM shall have suitable communication port for integration with SCADA system	
<b>D. CURRENT TRANSFORMERS</b>		
(i)	Type	Cast Resin Bar Primary
(ii)	Voltage class and frequency	650V, 50HZ
(iii)	CT Secondary Current	1 A
(iv)	Class of insulation	E or better
(v)	Accuracy class & burden	
(vi)	a) For Protection	5P20, 5VA
(vii)	b) For Metering	Class 1.0, 5VA (min)
(viii)	Instrument Security Factor for metering CT	5
<b>E. VOLTAGE TRANSFORMERS</b>		
(i)	Type	Cast Resin
(ii)	Voltage Ratio	415 / 110V for line PT 415/√3 / 110/√3V for Bus PT
(iii)	Method of Construction	Vee Vee
(iv)	Accuracy Class	0.5
(v)	Rated Voltage factor	1.1 continuous, 1.5 for 30 sec.
(vi)	Class of insulation	E or better



(vii)	One minute power frequency withstand voltage	2.5 KV
<b>F. HRC FUSES</b>		
(i)	Voltage Class	650 Volts
(ii)	Rupturing capacity	80kA (RMS) for AC circuits
<b>G. CONTACTORS</b>		
(i)	Type	Air break electro magnetic
(ii)	Utilising Category	AC3 of IS/IEC 60947 for non reversible AC4 of IS/IEC 60947 for reversible drives
<b>H. SWGR. CUBICLE CONSTRUCTIONAL REQUIREMENTS</b>		
(i)	Colour finish Exterior	RAL9002 (Main body) RAL 5012 (Extreme end covers) The paint thickness shall not be less than 50 microns
(ii)	Cable entry	
	Power Cables	Bottom
	Control Cables	Bottom

*The quantities/Nos. of the Feeders/MCCB shall be so as to meet the system requirements. 5% spare with minimum 01 No. to be provided on each board/switchgear having more than 5 MCCB. However no spare Air circuit breaker panels are required.*

## 6.2. DETAILS OF INDOOR DISTRIBUTION BOARDS

**Applicable for Auxiliary Power Supply system and String Inverter distribution board of rating upto & including 400A.**

- 6.2.1. Switchboards shall be of metal enclosed, indoor, floor-mounted, free- standing type.
- 6.2.2. All switchboard frames and load bearing members shall be fabricated using suitable mild steel structural sections or pressed and shaped cold- rolled sheet steel of thickness 2.0 mm. Frames shall be enclosed in cold- rolled sheet steel of thickness 1.6 mm. Doors and covers shall also be of cold rolled sheet steel of thickness 1.6 mm. Stiffeners shall be provided wherever necessary. The gland plate thickness shall be 3.0 mm for hot / cold-rolled sheet steel and 4.0 mm for non-magnetic material.
- 6.2.3. All panel edges and cover / door edges shall be reinforced against distortion by rolling, bending or by the addition of welded reinforcement members. The top covers of the panels should be designed such that they do not permanently bulge/ bend by the weight of maintenance personnel working on it.



- 6.2.4. The switchboards shall be of bolted design. The complete structures shall be rigid, self-supporting, and free from flaws, twists and bends. All cutouts shall be true in shape and devoid of sharp edges.
- 6.2.5. All switchboards shall be of dust-proof and vermin-proof construction and shall be provided with a degree of protection of IP: 5X as per IS/IEC 60947. All cutouts shall be provided with EPDM / Neoprene gaskets.
- 6.2.6. All switchboards shall be of uniform height not exceeding 2450 mm.
- 6.2.7. Switchboards shall be supplied with base frames made of structural steel sections, along with all necessary mounting hardware required for welding down the base frame to the foundation / steel insert plates.
- 6.2.8. All equipment and components shall be neatly arranged and shall be easily accessible for operation and maintenance. Replacement /Maintenance of individual equipment/ component shall be possible without switching off or isolating the other equipments/components.
- 6.2.9. Each switchboard shall be provided with undrilled, removable type gland plate. For all single core cables, gland plate shall be of non-magnetic material. The gland plate shall be provided with gasket to ensure enclosure protection.
- 6.2.10. The minimum clearance in air between phases and between phases and earth for the entire busbars shall be 25mm. For all other components, the clearance between "two live parts", "a live part and an earthed part", shall be at least ten (10) mm throughout. Wherever it is not possible to maintain these clearances, insulation shall be provided by sleeving or barriers. However, for busbars the clearances specified above should be maintained even when the busbars are sleeved or insulated. All connections from the busbars up to switch / fuses/MCCB shall be fully insulated and securely bolted to minimize the risk of phase to phase and phase to earth short circuits.
- 6.2.11. All busbars and jumper connections shall be of high conductivity aluminum alloy / copper of adequate size. All switchboards shall be provided with three phase and neutral busbars. Entire busbar system shall be insulated with PVC sleeves. Busbar sleeves shall be compliant to UL224 (Extruded insulating tubing), CE/UL certified, having fire retardant properties and working temperature of 105°C.
- 6.2.12. The cross-section of the busbars shall be uniform throughout the length of switchboard section and shall be adequately supported and braced to withstand the stresses due to the specified short circuit currents. Neutral busbar short circuit strength shall be same as main busbars.
- 6.2.13. All busbars shall be adequately supported by non-hygroscopic, non-combustible, track-resistant and high strength sheet molded compound or equivalent type polyester fiber glass molded insulator. Separate supports shall be provided for each phase and neutral busbar. If a common support is provided, anti-tracking barriers shall be provided between the supports. Insulator and barriers of inflammable material such as Hylam shall not be accepted. The

- busbar insulators shall be supported on the main structure.
- 6.2.14. All busbar joints shall be provided with high tensile steel bolts, belleville / spring washers and nuts, so as to ensure good contacts at the joints. Non- silver-plated busbar joints shall be thoroughly cleaned at the jointed locations and suitable contact grease shall be applied just before making a joint. All bolts shall be tightened by torque spanner to the recommended value. The overlap of the busbars at each joint surface shall be such that the length of overlap shall be equal to or greater than the width of the busbar. All copper to aluminium joints shall be provided with suitable bimetallic washers.
  - 6.2.15. All busbars shall be colour coded as per IS: 375.
  - 6.2.16. Wherever the busbars are painted with black Matt paint, the same should be suitable for temperature encountered in the switchboard under normal operating conditions.
  - 6.2.17. The Bidder shall furnish calculations establishing the adequacy of bus bar sizes for specified current ratings.
  - 6.2.18. Panel space heaters shall be provided and the supply for this shall be tapped from incomer, before the isolating switch/circuit breaker. Incoming circuit to space-heater shall have an isolating switch, HRC fuse and neutral link of suitable rating. Panel illumination and plug-socket shall also be tapped from the space heater supply.
  - 6.2.19. A galvanized steel / Copper / Aluminium earth bus shall be provided at the bottom of each panel and shall extend throughout the length of each switchboard. It shall be welded / bolted to the framework of each panel and breaker earthing contact bar. Vertical earth bus shall be provided in each vertical section which shall in turn be bolted / welded to main horizontal earth bus.
  - 6.2.20. The earth bus shall have sufficient cross section to carry the momentary short circuit and short time fault current to earth without exceeding the allowable temperature rise.
  - 6.2.21. All non-current carrying metal work of the switchboard shall be effectively bonded to the earth bus. Electrical conductivity of the whole switchgear enclosure framework and truck shall be maintained even after painting.
  - 6.2.22. All metallic cases of relays, instruments and other panel-mounted equipment shall be connected to earth by independent stranded copper wires of size not less than 2.5 sq. mm. All the equipment mounted on the door shall be earthed through flexible wire/braids. Insulation color code of earthing wires shall be green. Earthing wires shall be connected to terminals with suitable clamp connectors, soldering is not acceptable.
  - 6.2.23. Looping of earth connections, which would result in loss of earth connections to other devices, when a device is removed, is not acceptable. However, looping of earth connections between equipment to provide alternative paths to earth bus is acceptable.

- 6.2.24. VT and CT secondary neutral point earthing shall be at one place only, i.e. on the terminal block. Such earthing shall be made through links so that earthing of one secondary circuit shall be removed without disturbing the earthing of other circuit.
- 6.2.25. All hinged doors having potential carrying equipment mounted on it shall be earthed by flexible wire/ braid. For doors not having potential carrying equipment mounted on it, earth continuity through scraping hinges/ hinge pins of proven design may also acceptable. The Contractor shall establish earth continuity at site also.
- 6.2.26. All switchboards shall be supplied completely wired internally upto the terminals, ready to receive external cables.
- 6.2.27. All auxiliary wiring shall be carried out with 650V grade, single core stranded copper conductor, colour coded, PVC insulated wires. Conductor size shall be 1.5 mm<sup>2</sup> (min.) for control circuit wiring and 2.5 mm<sup>2</sup> (min) for CT and space heater circuits.
- 6.2.28. Extra flexible wires shall be used for wiring to devices mounted on moving parts such as hinged doors. The wire bunches from the panel inside to the doors shall be properly sleeved or taped.
- 6.2.29. All wiring shall be properly supported, neatly arranged, readily accessible and securely connected to equipment terminals and terminal blocks.
- 6.2.30. All internal wiring terminations shall be made with solderless crimping type tinned copper lugs which shall firmly grip the conductor or an equally secure method. Similar lugs shall also be provided at both ends of component-to-component wiring. Insulating sleeves shall be provided over the exposed parts of lugs to the extent possible. Screw-less (spring loaded) / cage clamp type terminal shall also be provided with lugs.
- 6.2.31. Printed single tube ferrules marked to correspond with panel wiring diagram shall be fitted at both ends of each wire. The wire identification marking shall be in accordance with IS: 375. Red Ferrules should be provided on trip circuit wiring.
- 6.2.32. Cable termination arrangement for power cables shall be suitable for heavy duty, 1.1 kV grade, stranded aluminum conductor, PVC/ XLPE insulated, armoured / unarmoured and PVC sheathed cables. All necessary cable terminating accessories such as supporting clamps and brackets, hardware etc., shall be provided by the contractor, to suit the final cable sizes.
- 6.2.33. All power cable terminals shall be of stud type and the power cable lugs shall be of tinned copper solderless crimping ring type conforming to IS: 8309. All lugs shall be insulated/ sleeved.
- 6.2.34. All Switchgears, MCCs, Distribution Boards, Fuse boards, all feeders, local push-button stations etc. shall be provided with prominent, engraved identification plates.

- 6.2.35. All name plates shall be of non-rusting metal or 3-ply Lamicoid, with white engraved lettering on black background. Inscription & lettering sizes shall be subject to Employer's approval.
- 6.2.36. Caution name plate "Caution Live Terminals" shall be provided at all points where the terminals are likely to remain live and isolation is possible only at remote end.
- 6.2.37. The gaskets, wherever specified, shall be of good quality EPDM / neoprene with good ageing, compression and oil resistance characteristics suitable for panel applications.
- 6.2.38. The bidder shall, ensure that the equipment offered will carry the required load current at site ambient conditions specified and perform the operating duties without exceeding the permissible temperature as per Indian standards / specification. Continuous current rating at 50 deg C ambient in no case shall be less than 90% of the normal rating specified.
- 6.2.39. ON/OFF status and protection trip status of incomers and bus coupler (if available) be provided for SCADA system.
- 6.2.40. Suitable changeover and interlocking arrangement shall be provided for incomers and bus coupler.
- 6.2.41. It shall be the responsibility of the contractor to fully coordinate the overload and short circuit breakers/fuses with the upstream and downstream circuit breakers / fuses, to provide satisfactory discrimination. Further the various equipment supplied shall meet the requirements of type ii class of co-ordination as per IS: 8544.
- 6.2.42. All sheet steel work shall be pretreated, in tanks, in accordance with IS: 6005. Degreasing shall be done by alkaline cleaning. Rust and scales shall be removed by pickling with acid. After pickling, the parts shall be washed in running water. Then these shall be rinsed in slightly alkaline hot water and dried. The phosphate coating shall be "class-c" as specified in IS: 6005. The phosphated surfaces shall be rinsed and passivated. After passivation, electrostatic powder coating shall be used. Powder should meet requirements of is 13871 (powder costing specification). Finishing paint shade for complete panels excluding end covers shall be RAL9002 & RAL5012 for extreme end covers of all boards, unless required otherwise by the employer. The paint thickness shall not be less than 50 microns.

### 6.3. MCCB

- 6.3.1. MCCB shall be fixed type module, air break type, having trip free mechanism with quick make and quick break type contacts. MCCB shall have current limiting feature. MCCB of identical ratings shall be physically and electrically interchangeable. MCCB shall be provided with 1 NO and 1NC auxiliary contacts.
- 6.3.2. MCCB shall be provided with Microprocessor based inbuilt front adjustable releases (overload & short circuit) and shall have adjustable earth fault

protection unit also. The protection settings shall have suitable range to achieve the required time & current settings. LED indications shall also be provided for faults, MCCB status (on/off etc).

- 6.3.3. MCCB terminals shall be shrouded and designed to receive cable lugs for cable sizes relevant to circuit rating. Extended cable terminal arrangement for higher size cable may also be offered. ON and OFF position of the operating handle of MCCB shall be displayed and the rotary operating handle shall be mounted on the door of the compartment housing MCCB. The compartment door shall be interlocked mechanically with the MCCB, such that the door cannot be opened unless the MCCB is in OFF position. Means shall be provided for defeating this interlock at any time. MCCB shall be provided with padlocking facility to enable the operating mechanism to be padlocked. The MCCBs being offered shall have common/interchangeable accessories for all ratings like aux. switch, shunt trip, alarm switch etc. The MCCBs shall have the current discrimination up to full short circuit capacity and shall be selected as per manufacturer's discrimination table.

#### 6.4. FUSES

- 6.4.1. All fuses shall be of HRC cartridge fuse link type. Screw type fuses shall not be accepted. Fuses for AC circuits shall be rated for 80kA rms (prospective) breaking capacity at 415V AC and for DC circuits, 20kA rms breaking capacity at 240V DC.
- 6.4.2. Fuse shall have visible operation indicators. Insulating barriers shall be provided between individual power fuses.
- 6.4.3. Fuse shall be mounted on insulated fuse carriers, which are mounted on fuse bases. Wherever it is not possible to mount fuses on carriers, fuses shall be directly mounted on plug-in type of bases. In such cases one set of insulated fuse pulling handles shall be supplied with each switchboard.
- 6.4.4. The Neutral links shall be mounted on fuse carriers which shall be mounted on fuse bases.

#### 6.5. INDOOR LT SWITCHGEAR FOR STRING INVERTER

In addition to the above clauses (relevant), the following shall also be applicable for switchgear ratings more than 400A.

- 6.5.1. All switchboards shall be divided into distinct vertical sections (panels), each comprising of the following compartments,
- a) **BUSBAR COMPARTMENT:** - A completely enclosed bus bar compartment shall be provided for the horizontal and vertical busbars. Bolted covers shall be provided for access to horizontal and vertical busbars and all joints for repair and maintenance, which shall be feasible without disturbing any feeder compartment. Auxiliary and power busbars shall be in separate compartments.
  - b) **SWITCHGEAR / FEEDER COMPARTMENT:** - All equipment associated with a feeder

of rating above 400A shall be housed in a separate compartment of the vertical section. ACB shall be provided for feeders of rating 1000A and above. The design of the vertical section for such an arrangement shall ensure ease of termination of power cables of size & quantity as per system requirement. The compartment shall be sheet steel enclosed on all sides with the withdrawable units in position or removed. Insulating sheet at rear of the compartment is also acceptable. The front of the compartment shall be provided with the hinged single leaf door with captive screws for positive closure.

- c) (c) CABLE COMPARTMENT/CABLE ALLEY: - A full-height vertical cable alley of minimum 250mm width shall be provided for power and control cables. Cable alley shall have no exposed live parts and shall have no communication with busbar compartment. Cable terminations located in cable alley of capacity more than 400 A shall be designed to meet the Form IVb (as per IEC 61439) for safety purpose. Wherever cable alleys are not provided for distribution boards, segregated cable boxes for individual feeders shall be provided at the rear for direct termination of cables. For circuit breaker external cable connections, a separately enclosed cable compartment shall also be acceptable. The contractor shall furnish suitable plugs to cover the cable openings in the partition between feeder compartment and cable alley. Cable alley door shall be hinged.
  - d) CONTROL COMPARTMENT: - A separate compartment shall be provided for relays and other control devices associated with a circuit breaker.
- 6.5.2. All switchboards shall be of dust-proof and vermin-proof construction and shall be provided with a degree of protection of IP: 5X as per IS/IEC 60947. However, the busbar chambers having a degree of protection of IP: 42 are also acceptable where continuous busbar rating is 1600A and above. Provision shall be made in all compartments for providing IP: 5X degree of protection, when circuit - breaker or module trolley has been removed. All cutouts shall be provided with EPDM / Neoprene gaskets.
- 6.5.3. Provision of louvers on switchboards would not be preferred. However, louvers backed with metal screen are acceptable on the busbar chambers where continuous busbar rating is 1600 A and above.
- 6.5.4. Sheet steel barriers shall be provided between two adjacent vertical panels running to the full height of the switchboard, except for the horizontal busbar compartment. EPDM / Neoprene gasket shall be provided between the panel sections to avoid ingress of dust into panels.
- 6.5.5. The minimum clearance in air between phases and between phases and earth for the entire busbars. and bus-link connections at circuit-breaker shall be 25mm. All busbars and jumper connections shall be of high conductivity aluminum alloy / copper of adequate size.
- 6.5.6. After isolation of power and control circuit connections it shall be possible to safely carryout maintenance in a compartment with the busbar and adjacent

circuit live. Necessary shrouding arrangement shall be provided for this purpose. Wherever two breaker compartments are provided in the same vertical section insulating barriers and shrouds shall be provided in the rear cable compartment to avoid accidental touch with the live parts of one circuit when working on the other circuit.

- 6.5.7. All switchgear (circuit-breaker) panels shall be of single-front type. The covers shall be provided with "DANGER" labels. All panel doors shall open by 90 deg or more.
- 6.5.8. All circuit-breaker modules shall be of fully draw out type having distinct 'Service' and 'Test' positions. Suitable arrangement with cradle / rollers, guides along with tool / lever operated racking in / out mechanism shall be provided for smooth and effortless movement of the chassis.
- 6.5.9. All switchboards shall be provided with three phase and neutral busbars. Two separate sets of vertical busbars shall be provided in each panel of double front DBs. Interleaving arrangement for busbars shall be adopted for switchboards with a rating of more than 1600A. Entire busbar system shall be insulated with PVC sleeves. Busbar sleeves shall be compliant to UL224 (Extruded insulating tubing), CE/UL certified, having fire retardant properties and working temperature of 105°C.
- 6.5.10. ON and OFF position of the operating handle of MCCB shall be displayed and the rotary operating handle shall be mounted on the door of the compartment housing MCCB. The compartment door shall be interlocked mechanically with the MCCB, such that the door cannot be opened unless the MCCB is in OFF position. Means shall be provided for defeating this interlock at any time. MCCB shall be provided with padlocking facility to enable the operating mechanism to be padlocked.
- 6.5.11. The module identification plate shall clearly give the feeder number and feeder designation. For single front switchboards, similar panel and board identification labels shall be provided at the rear switchgear also.
- 6.5.12. Temperature raise test of LT switchgear of rating more than 400A: - The temperature rise of the horizontal and vertical busbars and main bus links including all power draw out contacts when carrying 90% of the rated current along the full run shall in no case exceed 55 deg C with silver plated joints and 40 deg C with all other types of joints over an outside ambient temperature of 50 deg C. The temperature rise of the accessible parts/external enclosures expected to be touched in normal operation shall not exceed 20deg. C. The temperature rise of manual operating means shall not exceed 10deg. C for metallic & 15 deg. C for insulating material. Temperature rise for the busbars shall be carried out at 90% of the rated current.
- 6.5.13. The carriage and breaker frame shall get earthed while being inserted in the panel and positive earthing of the breaker frame shall be maintained in all





positions, i.e., SERVICE & ISOLATED, as well as throughout the intermediate travel.

- 6.5.14. Electrically controlled circuit breaker boards shall be provided with DC control supply.

## 6.6. CIRCUIT BREAKERS

- 6.6.1. Circuit breakers shall be three pole, air break, horizontal draw out type, and shall have fault making and breaking capacities as specified in "Technical Parameters". The circuit breakers which meet specified parameters of continuous current rating and fault making / breaking capacity only after provision of cooling fans or special device shall not be acceptable.
- 6.6.2. Circuit breakers along with its operating mechanism shall be provided with suitable arrangement for easy withdrawal. Suitable guides shall be provided to minimize misalignment of the breaker.
- 6.6.3. There shall be "SERVICE", "TEST" and "FULLY WITHDRAWN" positions for the breakers. In "Test" position the circuit breaker shall be capable of being tested for operation without energising the power circuits i.e. the power contacts shall be disconnected, while the control circuits shall remain undisturbed. Locking facilities shall be provided so as to prevent movement of the circuit breaker from the "SERVICE", "TEST" or "FULLLY WITHDRAWN" position. Circuit Breaker rack-in and rack-out from Service to Test, Test to Isolated position, or vice-versa shall be possible only in the compartment door closed condition.
- 6.6.4. Separate limit switches, each having required numbers of contacts shall be provided in both "SERVICE" and "TEST" position of the breaker. All contacts shall be rated for making, continuously carrying and breaking 10 Amp at 240 V AC and 1 Amp (Inductive) at 240 V DC respectively.
- 6.6.5. Suitable mechanical indications shall be provided on all circuit breakers to show "OPEN", "CLOSE", "SERVICE", "TEST" AND "SPRING CHARGED" positions.
- 6.6.6. Main poles of the circuit breakers shall operate simultaneously in such a way that the maximum difference between the instants of contacts touching during closing shall not exceed half a cycle of rated frequency.
- 6.6.7. Movement of a circuit breaker between "SERVICE" and "TEST" position shall not be possible unless it is in open position. Attempted withdrawal of a closed-circuit breaker shall preferably not trip the circuit breaker. In case the offered circuit breaker trips on attempted withdrawal as a standard interlock, it shall be ensured that sufficient contact exists between the fixed and drawout contact at the time of breaker trip so that no arcing takes place even with the breaker carrying its full rated current.
- 6.6.8. Closing of a circuit breaker shall not be possible unless it is in "SERVICE" position, "TEST" position or in "FULLY WITHDRAWN" position.
- 6.6.9. Circuit-breaker cubicles shall be provided with safety shutters operated automatically by the movement of the circuit breaker carriage, to cover the



- stationary isolated contacts when the breaker is withdrawn. It shall however be possible to open the shutters intentionally against pressure for testing purposes.
- 6.6.10. Breaker of particular rating shall be prevented from insertion in a cubicle of a different rating.
  - 6.6.11. Circuit breakers shall be provided with coded key / electrical interlocking devices, as per requirements.
  - 6.6.12. Circuit breaker shall be provided with anti-pumping feature and trip free feature, even if mechanical anti-pumping feature is provided.
  - 6.6.13. Mechanical tripping shall be possible by means of front mounted Red "trip" push-button. In case of electrically operated breakers these push buttons shall be shrouded to prevent accidental operation.
  - 6.6.14. Complete shrouding / segregation shall be provided between incoming and outgoing bus links of breakers. In case of bus coupler breaker panels the busbar connection to and from the breaker terminals shall be segregated such that each connection can be approached and maintained independently with the other bus section live. Dummy panels if required to achieve the above feature shall be included in the Bidder's scope of supply.
  - 6.6.15. Circuit breaker open/close shall be possible from SCADA and open/close status and all other important signal status shall be provided for SCADA monitoring.
  - 6.6.16. Power operated mechanism shall be provided with a Universal motor suitable for operation on DC Control supply. In case of DC supply motor should satisfactorily operate with voltage variation between 85% to 110% nominal control supply voltage. Motor insulation shall be class "E" or better.
  - 6.6.17. The motor shall be such that it requires not more than 30 Seconds for fully charging the closing spring at minimum available control voltage. Once the closing springs are discharged, after one closing operation of circuit breaker, it shall automatically initiate recharging of the spring.
  - 6.6.18. The mechanism shall be such that as long as power is available to the motor, a continuous sequence of closing and opening operations shall be possible. After failure of power supply at least one open-close-open operation shall be possible.
  - 6.6.19. Provision shall be made for emergency manual charging and as soon as this manual charging handle is coupled, the motor shall automatically get mechanically decoupled.
  - 6.6.20. All circuit breakers shall be provided with closing and trip coils. The closing coil shall operate correctly at all values of voltage between 85% to 110% nominal control supply voltage. The trip coil shall operate satisfactorily at all values of voltage between 70% to 110% nominal control supply voltage.
  - 6.6.21. Provision for mechanical closing of the breaker only in "Test" and "WITHDRAWN" positions shall be made. Alternately, the mechanical closing facility shall be normally made inaccessible; accessibility being rendered only after deliberate removal of shrouds.

- 6.6.22. The ACB Panel door shall not be possible to open in breaker closed condition. Further, the racking mechanism shall be accessible only after opening the breaker panel door.
- 6.6.23. Telescopic trolley or suitable arrangement shall be provided for maintenance of circuit-breaker module in a cubicle at each location. The trolley shall be such that the top most breaker module can be withdrawn on the trolley and can be lowered for maintenance purpose. The telescopic trolley shall be such that all type, size and rating of breaker can be withdrawn /inserted of particular switchgear.

**6.6.24. Electrical Parameter of Circuit Breaker**

1)	Type	Air break spring charged stored energy type
2)	Operating duty	O-3 MIN-OC-3 MIN-OC
3)	Symmetrical interrupting	As per system fault current (for one sec)
4)	Short circuit rating	2.1 times of System fault current (peak)
5)	Short Circuit Breaking current	
	a) AC Component	As per system fault current (for one sec)
	b) DC Component	As per IS:13947
6)	Short time withstand	As per system fault current

**6.7. AC JUNCTION BOXES (FOR USE WITH STRING INVERTERS)**

- 6.7.1. Separate AC Junction box shall be used for string inverters AC output connection. Protection class for AC junction box shall be IP 54 or better protection. All components of junction box shall be suitable for rated output voltage (with + 10% variation) of string inverter, grid frequency of 50 Hz +/- 5%, ambient temperature 50 deg. C and system fault current for 1 sec.
- 6.7.2. AC junction box shall be of metal enclosed type. All frames and load bearing members shall be fabricated using suitable mild steel structural sections or pressed and shaped cold-rolled sheet steel of thickness 2.0 mm. Frames shall be enclosed in cold-rolled sheet steel of thickness 1.6 mm. Doors and covers shall also be of cold rolled sheet steel of thickness
- 6.7.3. 1.6 mm. Stiffeners shall be provided wherever necessary. The gland plate thickness shall be 3.0 mm for hot / cold-rolled sheet steel and 4.0 mm for non-magnetic material. The minimum clearance in air between phases and between phases and earth shall be at least twenty five (25) mm throughout. Wherever it is not possible to maintain these clearances, insulation shall be provided by sleeving or barriers.



- 6.7.4. All power cable terminals shall be of stud type and the power cable lugs shall be of tinned copper solderless crimping ring type conforming to IS: 8309. All lugs shall be insulated/ sleeved.
- 6.7.5. EPDM / Neoprene gasket shall be used to prevent ingress of dust into panels.
- 6.7.6. All non-current carrying metal work of the junction box shall be effectively connected to the system earth bus.
- 6.7.7. Finishing paint shade for complete panels excluding end covers shall be RAL9002 & RAL5012 for extreme end covers of all boards, unless required otherwise by the Employer. The paint thickness shall not be less than 50 microns.

**6.8. TEMPERATURE-RISE (For LT Switch-gear having capacity more than 400A)**

- 6.8.1. The temperature rise of the horizontal and vertical busbars and main bus links including all power draw out contacts when carrying 90% of the rated current along the full run shall in no case exceed 55 deg C with silver plated joints and 40 deg C with all other types of joints over an outside ambient temperature of 50 deg C. The temperature rise of the accessible parts/external enclosures expected to be touched in normal operation shall not exceed 20deg. C. The temperature rise of manual operating means shall not exceed 10deg. C for metallic & 15 deg. C for insulating material. Temperature rise for the busbars shall be carried out at 90% of the rated current.

**6.9. DERATING OF COMPONENTS**

- 6.9.1. The Bidder shall, ensure that the equipment offered will carry the required load current at site ambient conditions specified and perform the operating duties without exceeding the permissible temperature as per Indian Standards / Specification. Continuous current rating at 50 deg C ambient in no case shall be less than 90% of the normal rating specified. The Bidder shall indicate clearly the derating factors if any employed for each component and furnish the basis for arriving at these derating factors duly considering the specified current ratings and amb. temperature of 50 deg C.

**2. HT SWITCHGEAR**

**2.1. CODES AND STANDARDS**

All standards, specification and codes of practices referred to herein shall be the latest editions including all applicable official amendments and revisions as on date of opening of Techno commercial bid. In case of conflict between this specification and those (IS Codes, Standards etc.) referred to herein, the former shall prevail. All work shall be carried out as per the following standards and codes.

<b>S. No</b>	<b>IS Code</b>	<b>Name Of Equipment</b>
a)	IS: 722	AC electricity meters.

b)	IS: 996	Single phase small AC and universal electrical motors.
c)	IS: 1248	Direct Acting indicating analogue electrical measuring instruments and Accessories.
d)	IS/IEC: 60947	Degree of protection provided by enclosures for low voltage switchgear and control gear.
e)	IS: 2544	Porcelain post insulators for systems with nominal voltages greater than 1000 Volts.
f)	IS: 2705	Current transformers.
g)	IS: 3156	Voltage Transformers
h)	IS: 6005	Code of practice for phosphating of iron and steel.
i)	IS: 5082	Specification for wrought aluminium and aluminium alloy bars, rods, tubes and selections for electrical purposes.
j)	IEC: 61850	Communication Standard for Numerical relays
k)	IEC: 61131-3	Automation Standard for Numerical relays
l)	IS: 9046	AC contactors for voltages above 1000 volts and upto and including 11000 Volts.
m)	IS: 13703	Low voltage fuses
n)	IS: 9385	HV fuses
o)	IS: 9431	Specification for indoor post insulators of organic material for system with nominal voltages greater than 1000 volts upto and including 300 kV
p)	IS: 9921	A.C. disconnectors (isolators) and Earthing switches for voltages above 1000 V
q)	IS: 11353	Guide for uniform system of marking and identification of conductors and apparatus terminals.
r)	IS: 13118	Specification for high voltage AC circuit breakers.
s)	IEC: 60099-4	Metal oxide surge arrestor without gap for AC system
t)	IS/IEC: 62271- 100	High voltage alternating current circuit breakers.
u)	IS/IEC: 62271- 200	High voltage metal enclosed switchgear and control gear.
v)	IEC: 60947-7-1	Terminal blocks for copper conductors
w)	IS :513 (2008)	Cold Rolled Low Carbon Steel Sheets and Strips

## 2.2. TECHNICAL PARAMETERS

<b>A. SYSTEM PARAMETERS</b>		
a)	Nominal System voltage	33kV

b)	Highest System voltage	36kV
c)	Rated Frequency	50Hz
d)	Number of phases/ poles	Three
e)	System neutral earthing	Solidly Earthed
f)	One minute power frequency withstand voltage	
	- for Type tests	70kV
	- for Routine tests	70kV
g)	1.2/50 microsecond Impulse withstand voltage	170kV (peak)
h)	Minimum system fault level	As per SLD
i)	Short time rating for bus bars, circuit breakers, current transformers and switchgear assembly.	As per system fault level specified in tender SLD for one (1) sec.
j)	Dynamic withstand rating	2.5 times of system fault current as specified in tender SLD
k)	- Space heaters	240 V AC single phase with neutral solidly earthed
l)	Maximum ambient air temperature	50 deg. C
m)	Internal Arc testing	As Specified in chapter-A2
<b>B. BUS BARS</b>		
a)	Continuous current rating at 50 <sup>0</sup> C ambient:	As Per Requirement
b)	Temper Rise allowed above ambient	0 40 C for plain joints 55 C for Silver plated joints
<b>C. SWGR. CUBICLE CONSTRUCTIONAL REQUIREMENTS</b>		
a)	Colour finish	
	Exterior	RAL9002 (Main body) RAL 5012 (Extreme end covers)
b)	Cable entry	
	Power Cables	Bottom

	Control Cables	Bottom
c)	Earthing conductor	Galvanized steel strip
d)	Service Continuity of swgrs (LSC2B-PM)	as per IS/IEC 62271-200
<b>D. CIRCUIT BREAKERS</b>		
a)	The circuit breakers current rating shall be selected from the load current at an ambient of 50 deg. C.	
b)	Short circuit breaker Current	
	a) A.C. component	As per system fault current specified in tender SLD
	b) D.C. component	As per IS: 13118 or IEC-62271
c)	Short Circuit making current	2.5 times of system fault current (peak) specified in tender SLD
d)	Operating Duty	O-3 min-CO-3 min-CO
e)	Total break time	Not more than 4 cycles
f)	Total make time	Not more than 5 cycles
g)	Operating Mechanism	Motor wound spring charged stored energy type as per IEC-62271
<b>E. CURRENT TRANSFORMER</b>		
a)	Secondary Current	1A
b)	Class of Insulation	Class E or better
c)	Rated output of each	Adequate for the relays and devices connected, but not less than five (5) VA.
d)	Accuracy class	
	Protection	5P20
	Measurement	0.5 class / as per tender SLD
e)	Instrument Security Factor for Measurement CTs	5
f)	CT Ratio	CT ratio shall be finalized during details engineering stage. Minimum CT primary side current shall be 110% of rated current.
<b>F. VOLTAGE TRANSFORMERS</b>		
a)	Rated Voltage Factor	1.2 continuous for all VTs, and 1.9 for 8 Hours for star connected VTs.
b)	Class of insulation	Class E or better

c)	Other parameters	0.5 Class. VA requirement shall be application requirement. Suitable damping resistor and additional open delta core with loading resistor shall be provided in all VT's to prevent damage on account of Ferro-Resonance conditions
<b>G. DIGITAL MFM</b>		
Accuracy Class	0.5 or better	
Digital MFM shall be provided for VCB panels as shown in SLD.		

### 2.3. SWITCHGEAR PANEL

- 2.3.1. The switchgear boards shall have a single front, single tier, fully compartmentalized, metal enclosed construction complying with clause No. 3.102 of IEC 62271-200, comprising of a row of free-standing floor mounted panels. Each circuit shall have a separate vertical panel with distinct compartments for circuit breaker truck, cable termination, main busbars and auxiliary control devices. The adjacent panels shall be completely separated by steel / Aluzinc sheets except in bus bar compartments where insulated barriers shall be provided to segregate adjacent panels. The Service Class Continuity of Switchgears shall be LSC 2B-PM (as per IS/ IEC 622771-200). However, manufacturer's standard switchgear designs without inter panel barriers in busbar compartment may also be considered.
- 2.3.2. The circuit breakers and bus VTs shall be mounted on withdrawable trucks which shall roll out horizontally from service position to isolated position. For complete withdrawal from the panel, the truck shall rollout on the floor or shall roll out on telescopic rails. In case the later arrangement is offered, suitable trolley shall be provided by the Bidder for withdrawal and insertion of the truck from and into the panel. Testing of the breaker shall be possible in isolated position by keeping the control plug connected.
- 2.3.3. The trucks shall have distinct SERVICE and ISOLATED positions. It shall be possible to close the breaker compartment door in isolated position also, so that the switchgear retains its specified degree of protection. Circuit Breaker rack-in and rack-out from Service to Test, Test to Isolated position, or vice-versa shall be possible only in the compartment door closed condition. While switchboard designs with doors for breaker compartments would be preferred, standard designs of reputed switchgear manufacturers where the truck front serves as the compartment cover may also be considered provided the breaker compartment is completely sealed from all other compartments and retains the IP-4X degree of protection in the Isolated position. In case the latter arrangement is offered, the Bidder shall explain how this sealing is achieved and



- shall include blanking covers one for each size of panel per switchboard in his total Techno commercial bid price.
- 2.3.4. The switchgear assembly shall be dust, moisture, rodent and vermin proof, with the truck in any position SERVICE, ISOLATED or removed, and all doors and covers closed. All doors, removable covers and glass windows shall have gaskets all round with synthetic rubber or neoprene gaskets.
  - 2.3.5. The control / relay compartments shall have degree of protection not less than IP 5X in accordance with IS/IEC 60947. However, remaining compartments can have a degree of protection of IP 4X. All louvers, if provided, shall have very fine brass or GI mesh screen. Tight fitting gaskets / gaskets are to be provided at all openings in relay compartment. Numerical Relays shall be fully Flush mounted on the switchgear panels at a suitable height.
  - 2.3.6. The Switchgear shall have an internal Arc Classification of IAC FLR as specified above. The switchgear construction shall be such that the operating personnel are not endangered by breaker operation and internal explosions, and the front of the panels shall be specially designed to withstand these. Pressure relief device shall be provided in each high voltage compartment of a panel, so that in case of a fault in a compartment, the gases produced are safely vented out, thereby minimizing the possibility of its spreading to other compartments and panels. The pressure relief device shall not however reduce the degree of protection of panels under normal working conditions. To demonstrate that the pressure relief device operates satisfactorily the Contractor shall submit a type test report in line with IEC 62271- 200 Annex – A for each high voltage chamber. Wherever louvers are provided, the construction of louvers should be such that the IAC requirements are satisfied. Further, viewing glass windows shall have the same strength as the enclosure against Internal Arc.
  - 2.3.7. Enclosure shall be constructed with rolled steel / Aluzinc sections. The doors and covers shall be constructed from cold rolled steel sheets of 2.0 mm or higher thickness. Gland plates shall be 2.5 mm thick made out of hot rolled or cold rolled steel sheets and for non-magnetic material it shall be 3.0 mm.
  - 2.3.8. The switchgear shall be cooled by natural air flow.
  - 2.3.9. Total height of the switchgear panels shall not exceed 2600mm. The height of switches, pushbuttons and other hand operated devices shall not exceed 1800mm and shall not be less than 700mm.
  - 2.3.10. Necessary guide channels shall be provided in the breaker compartments for proper alignment of plug and socket contacts when truck is being moved to SERVICE position. A crank or lever arrangement shall preferably be provided for smooth and positive movement of truck between Service and Isolated positions.
  - 2.3.11. Safety shutters complying with IEC 62271-200 shall be provided to cover up the fixed high voltage contacts on busbar and cable sides when the truck is moved to ISOLATED position. The shutters shall move automatically, through a linkage

with the movement of the truck. Preferably it shall however, be possible to open the shutters of busbar side and cable side individually against spring pressure for testing purpose after defeating the interlock with truck movement deliberately. In case, insulating shutters are provided, these shall meet the requirements of IEC 62271-200 and necessary tests as per IEC 62271-200 Clause 5.103.3.3 shall be carried out. A clearly visible warning label "Isolate elsewhere before earthing" shall be provided on the shutters of incoming and tie connections which could be energized from other end.

- 2.3.12. Switchgear construction shall have a bushing or other sealing arrangement between the circuit breaker compartment and the busbar / cable compartments, so that there is no air communication around the isolating contacts in the shutter area with the truck in service position.
- 2.3.13. The breaker and the auxiliary compartments provided on the front side shall have strong hinged doors. Busbar and cabling compartments provided on the rear side shall have separate bolted covers with self-retaining bolts for easy maintenance and safety. Breaker compartment doors shall be provided with single-shot latch type handle and shall have locking facility. Suitable interlock shall be provided, which will ensure that breaker is OFF before opening the back doors. Suitable interlock shall be provided to prevent opening of any compartment doors which has any of the MV equipment, in case the supply is ON.
- 2.3.14. In the Service position, the truck shall be so secured that it is not displaced by short circuit forces. Busbars, jumpers and other components of the switchgear shall also be properly supported to withstand all possible short circuit forces corresponding to the short circuit rating specified.
- 2.3.15. Suitable base frames made out of steel channels shall be supplied along with necessary anchor bolts and other hardware, for mounting of the switchgear panels. These shall be dispatched in advance so that they may be installed and leveled when the flooring is being done, welding of base frame to the insert plates as per approved installation drawings shall be in Bidder's scope.
- 2.3.16. Alternatively, Outdoor HT switchgear can be offered. The outdoor switchgear shall have minimum IP 55 or better protection. The bidder shall submit the relevant details of the switchgear including the datasheets, drawings and applicable type test reports during the detailed engineering for Employers approval. Internal Arc requirement shall be same as indoor type switchgear.

## **2.4. CIRCUIT BREAKERS**

- 2.4.1. The circuit breakers shall be of Vacuum type.
- 2.4.2. They shall comprise of three separate, identical single pole interrupting units, operated through a common shaft by a sturdy operating mechanism.
- 2.4.3. Circuit breaker shall be restrike free, stored energy operated and trip free type.

Motor wound closing spring charging shall only be acceptable. An anti-pumping relay shall be provided for each breaker, even if it has built-in mechanical anti-pumping features. An arrangement of two breakers in parallel to meet a specified current rating shall not be acceptable.

- 2.4.4. During closing, main poles shall not rebound objectionably and mechanism shall not require adjustments. Necessary dampers shall be provided to withstand the impact at the end of opening stroke.
- 2.4.5. Plug and socket isolating Contacts for main power circuit shall be silver plated, of self-aligning type, of robust design and capable of withstanding the specified short circuit currents. They shall preferably be shrouded with an insulating material. Plug and socket contacts for auxiliary circuits shall also be silver plated, sturdy and of self-aligning type having a high degree of reliability. Thickness of silver plating shall not be less than 10 microns.
- 2.4.6. All working part of the mechanism shall be of corrosion resisting material. Bearings which require greasing shall be equipped with pressure type grease fittings. Bearing pins, bolts, nuts and other parts shall be adequately secured and locked to prevent loosening or change in adjustment due to repeated operation of the breaker and the mechanism.
- 2.4.7. The operating mechanism shall be such that failure of any auxiliary spring shall not prevent tripping and shall not lead to closing or tripping of circuit breaker. Failure of any auxiliary spring shall also not cause damage to the circuit breaker or endanger the operator.
- 2.4.8. Mechanical indicators shall be provided on the breaker trucks to indicate OPEN / CLOSED conditions of the circuit breaker, and CHARGED / DISCHARGED conditions of the closing spring. An operation counter shall also be provided. These shall be visible without opening the breaker compartment door.
- 2.4.9. The rated control supply voltage shall be as mentioned elsewhere under Technical parameters. The closing coil and spring charging motor shall operate satisfactorily at all values of control supply voltage between 85% to 110% rated DC voltage. The shunt trip coil shall operate satisfactorily under all operating conditions of the circuit breaker upto its rated short circuit breaking current at all values of control supply voltage between 70% to 110% of rated DC voltage. The trip coil shall be so designed that it does not get energized when its healthiness is monitored by two indicating lamps (Red) and one trip coil supervision relay.
- 2.4.10. The time taken for charging of closing spring shall not exceed 30 seconds. The spring charging shall take place automatically preferably after a closing operation. Breaker operation shall be independent of the spring charging motor which shall only charge the closing spring. Opening spring shall get charged automatically during closing operation. As long as power supply is available to the charging motor a continuous sequence of closing and opening operations



shall be possible. One open-close- open operation of the circuit breaker shall be possible after failure of power supply to the motor. Spring charging motors shall be capable of starting and charging the closing spring twice in quick succession without exceeding acceptable winding temperature when the control supply voltage is anywhere between 85% to 110% rated DC voltage. The initial temperature shall be as prevalent in the switchgear panel during full load operation with 50 deg. C ambient air temperature. The motor shall be provided with short circuit protection.

- 2.4.11. Motor windings shall be provided with class E insulation or better. The insulation shall be given tropical and fungicidal treatment for successful operation of the motor in a hot, humid and tropical climate.
- 2.4.12. Circuit breaker shall be provided with inter pole barriers of insulating materials. The use of inflammable materials like Hylam shall not be acceptable.

## **2.5. CONTROLS AND INTERLOCKS**

- 2.5.1. Rotary type Control switches shall be provided in each switchgear panel. The circuit breaker will normally be controlled from remote control panels through closing and shunt trip coils. The control switch and local control console of the relay flush mounted on the switchgear would normally be used only for testing of circuit breaker in isolated position, and for tripping it in an emergency. The closing and opening of the breaker shall also be possible from the Laptop through front serial port of the relay to facilitate commissioning activities.
- 2.5.2. The basic control scheme shall be developed in the numerical relay using programmable (soft) logics.
- 2.5.3. Facilities shall be provided for mechanical tripping of the breaker and for manual charging of the stored energy mechanism for a complete duty cycle, in an emergency.
- 2.5.4. Each panel shall have two separate limit switches, one for the Service position and the other for isolated position.
- 2.5.5. Auxiliary Contacts of breaker may be mounted in the fixed portion or in the withdrawable truck as per the standard practice of the manufacturer, and shall be directly operated by the breaker operating mechanism.
- 2.5.6. Auxiliary contacts mounted in the fixed portion shall not be operable by the operating mechanism, once the truck is withdrawn from the service position, but remain in the position corresponding to breaker open position. Auxiliary contacts mounted on the truck portion, and dedicated for Employer's use shall be wired out in series with a contact denoting breaker service position. With truck withdrawn, the auxiliary contacts shall be operable by hand for testing. There shall be at least 2 NO and 2 NC breaker/contactors original Auxiliary contacts made available for the of the Employer's use.
- 2.5.7. The contacts of all limit switches and all breaker auxiliary contacts located on



truck portion and fixed portion shall be silver plated, rated to make, carry and break 1.0A 240V DC (Inductive) / 10A 240V AC. Contacts of control plug and socket shall be capable of carrying the above current continuously.

- 2.5.8. Movement of truck between SERVICE and ISOLATED positions shall be mechanically prevented when the breaker is closed. An attempt to withdraw a closed breaker shall not trip it.
- 2.5.9. Closing of the breaker shall be possible only when truck is either in ISOLATED or in SERVICE position and shall not be possible when truck is in between. Further, closing shall be possible only when the auxiliary circuits to breaker truck have been connected up, and closing spring is fully charged.
- 2.5.10. It shall be possible to easily insert breaker of one typical rating into any one of the panels meant for same rating but at the same time shall be prevented from inserting it into panels meant for a different type or rating.
- 2.5.11. Indications shall be provided in the relay console flush mounted on the panel front as brought out in the specification elsewhere. It shall be possible to easily make out whether the truck is in SERVICE OR ISOLATED POSITION even when the compartment door is closed.
- 2.5.12. Reverse blocking and Inter tripping shall be implemented in switchgear boards level. Detailed scheme for the same shall be finalized during detailed engineering stage.
- 2.5.13. All required interlock shall be provided for safe operation of switchgears. Capacitive voltage detection or other alternative suitable arrangement (VT shall not be used) shall be used for outgoing feeder backdoor (cable chamber) open interlock.

## **2.6. NUMERICAL RELAYS AND NETWORKING**

- 2.6.1. Numerical relays (IED, i.e., Intelligent Electronic Device) shall comply with IEC-61850, having protection, control, measurement and monitoring features. These relays shall be networked and suitably interfaced with the Solar SCADA system for dynamic SLD display, status monitoring, measurements, event / alarm displays, reports, etc. The relays shall be flush mounted on panel front with connections from the inside. These numerical relays shall be of types as proven for the application and shall be subject to Employer's approval. Numerical relays shall have appropriate setting ranges, accuracy, resetting ratio and other characteristics to provide required sensitivity. All equipments shall have necessary protections.
- 2.6.2. The numerical relay shall be capable of measuring and storing values of a wide range of quantities, events, faults and disturbance recordings. The alarm / status of each of protection function and trip operation shall be communicated to Solar SCADA. The numerical relays shall have built in feature / hardware interface to provide such inputs to Solar SCADA / for analog / digital values.

- 2.6.3. All relays shall be rated for control supply voltage as mentioned elsewhere under parameters and shall be capable of satisfactory continuous operation between 80- 120% of the rated voltage. Making, carrying and breaking current ratings of their contacts shall be adequate for the circuits in which they are used. Contacts for breaker close and trip commands shall be so rated as to be used directly used in the closing and tripping circuits of breaker without the need of any interposing / master trip relays. Threshold voltage for binary inputs shall be suitably selected to ensure avoidance of mal operation due to stray voltages and typically shall be more than 70% of the rated control supply voltage.
- 2.6.4. One minute power frequency withstand test voltage for all numerical relays shall at least be 2kV (rms).
- 2.6.5. Failure of a control supply and de-energization of a relay shall not initiate any circuit breaker operation.
- 2.6.6. Disturbance Record waveforms, event records & alarms shall be stored in Non-volatile memory and failure of control supply shall not result in deletion of any of these data.
- 2.6.7. All numerical relays shall have freely programmable optically isolated binary inputs (BI) and potential free binary output (BO) contacts as per the requirement of control schematics. The quantities of such input / outputs shall be finalized during detailed engineering.
- 2.6.8. All the numerical relays shall have communications on two ports, local front port communication to laptop and rear port on IEC 61850 to communicate with the interface equipment for connectivity with the Solar SCADA. Laptop provided with PCU/SCADA shall be used to facilitate numerical relay configuration, DR and event/fault records downloading from relay locally. Latest version of hardware and Software for interfacing the numerical relays with laptop shall be provided. At least two sets of communication cable for Laptop to relay communication shall be provided.
- 2.6.9. All the numerical relays shall have adequate processor memory for implementing the programmable scheme logic required for the realization of the protection / control schemes, in addition to the built in protection algorithms. Numerical relays shall have inrush detection feature for blocking of user selectable protection functions.
- 2.6.10. Numerical relays used at main pooling switchgear shall have features for electrical measurements including voltage, current, power (active & reactive), frequency, power-factor and energy parameters. All other location the numerical relay shall have feature of current measurement. Relay shall be able to provide the same in soft to solar SCADA system.
- 2.6.11. Relays shall have event recording feature, recording of abnormalities and operating parameters with time stamping.
- 2.6.12. Master trip (86) and non-86 trips shall be software configurable to output

- contacts and no separate master trip relay shall be used.
- 2.6.13. Numerical relays used at main pooling switchgear shall have provision of both current and voltage inputs. Number of CT inputs shall be as per actual protections requirement but not less than 4 sets, 3 nos. for phase fault & 1 no. for earth fault. Relays shall be suitable for CT secondary current of 1A. At 33kV main pooling switchgear (switchgear with two outgoing and one bus coupler arrangement) outgoing feeders (to grid) and bus coupler numerical relay shall have provision of 4 VT inputs for metering, protection and synchronization purpose. All 33kV feeders shall be provided with non-directional EF and OC protection. Numerical relays used at main pooling switchgear shall have voltage protection and measurement feature.
- 2.6.14. Relay setting shall be based on time grading principle with minimum 100mSec shall be the grading margin. Least time setting at inverter transformer feeders and shall be increased towards the evacuation point (towards grid). Relay time setting shall be minimum 100 mSec. However, relay current and time setting including time grading margin shall be as per Bidder offered system (with minimum as per above) considering smooth plant operation and proper protection integration/coordination with grid. Bidder can use same relay time setting for tie feeder panels between two switchgears. Relay setting of solar plant feeders shall be done in coordination with 33kV main pooling switch (grid side) relay setting. Collection of the relay setting of main pooling switchgear from the respective state authority is in the bidder scope. Any special/other protections, control interlocks etc as per requirement shall be provided by the Bidder. Details shall be finalized during details engineering stage.
- 2.6.15. For relay setting calculation grid side shall be taken upstream and inverter side shall be taken downstream. For any switchgear outgoing feeder shall be towards grid and incoming feeders shall be towards inverter shall be considered.
- 2.6.16. All CT & VT terminals on the relays shall be of fixed type suitable for connection of ring-type lugs to avoid any hazard due to loose connection leading to CT open- circuit. In no circumstances Plug In type connectors shall be used for CT / VT connections.
- 2.6.17. All numerical relay shall have key pad / keys to allow relay settings from relay front. All hand reset relays shall have reset button on the relay front. Relay to be self or hand reset shall be software selectable. Manual resetting shall be possible from remote.
- 2.6.18. Relays shall have self-diagnostic feature with self-check for power failure, programmable routines, memory and main CPU failures and a separate output contact for indication of any failure.
- 2.6.19. Relays shall have at least two sets or groups of two different sets of adaptable settings. Relays shall have multiple IEC / ANSI programmable characteristics.
- 2.6.20. Design of the relay must be immune to any kind of electromagnetic interference.



Vendor shall submit all related type test reports for the offered model along with the offer.

- 2.6.21. All cards / hardware of numerical relays shall be suitable for operation in Harsh Environmental conditions with respect to high temperature, humidity & dust.
- 2.6.22. Relay shall be immune to capacitance effect due to long length of connected control cables. Any external hardware, if required for avoiding mal operation of the relay due to cable capacitance shall be included as a standard feature.
- 2.6.23. All I/Os shall have galvanic isolation. Analog inputs shall be protected against switching surges, harmonics etc.
- 2.6.24. Numerical relays shall have two level password protections, one for read only and other for authorization for modifying the setting etc.
- 2.6.25. Numerical relays shall have feature for Time synchronization through the SCADA System / networking. The resolution of time synchronization shall be +/- 1.0 millisecond or better throughout the entire system.
- 2.6.26. Relays shall be suitable to accept both AC & DC supplies with range of 70 % to 120 % of rated voltage.
- 2.6.27. Disturbance Record waveforms, event records & alarms shall be stored in Non-volatile memory and failure of control supply shall not result in deletion of any of these data.
- 2.6.28. Bidder to depute relay OEM protection engineer at MAHAPREIT EOC office for finalization of relay setting and configuration during detail engineering stage. All numerical protection relay configuration and setting shall be done as per approved setting and configuration at switchgear manufacturer work by relay OEM or his authorized representative. All numerical relay testing and logic/interlock checking during commissioning stage at site shall be done under the supervision of Relay OEM or his authorized representative.

## **2.7. OTHER PROTECTIONS AND CONTROL FUNCTIONS IN THE RELAYS**

- 2.7.1. Trip circuit supervision shall be provided for all feeders to monitor the circuit breaker trip circuit both in pre-trip and post trip conditions.
- 2.7.2. Schematics requiring auxiliary relays / timers for protection function shall be a part of numerical relay. The number of auxiliary relay and timer function for protection function shall be as required. Timer functions shall be programmable for on/off delays.
- 2.7.3. The numerical relay shall be able to provide supervisory functions such as trip circuit monitoring, circuit breaker state monitoring, PT and CT supervisions and recording facilities with Post fault analysis.
- 2.7.4. The numerical processor shall be capable of measuring and storing values of a wide range of quantities, all events, faults and disturbance recordings with a time stamping using the internal real time clock. Battery backup for real time clock in the event of power supply failure shall be provided.



- 2.7.5. At least 200 time tagged events / records shall be stored with time stamping. Details of at least 5 previous faults including the type of protection operated, operating time, all currents & voltages and time of fault.
- 2.7.6. Diagnostics Automatic testing, power on diagnostics with continuous monitoring to ensure high degree of reliability shall be provided. The results of the self-reset functions shall be stored in battery back memory. Test features such as examination of input quantities, status of digital inputs and relay outputs shall be shall be available on the user interface.
- 2.7.7. The alarm/status of each individual protection function and trip operation shall be communicated to solar SCADA.
- 2.7.8. Sequence of events shall have 1 ms resolution at device level. Measurement accuracy shall be 1 % for RMS Current and voltage.

## **2.8. BUSBARS AND INSULATORS**

- 2.8.1. All Busbar and jumper connections shall be of high conductivity aluminium alloy. They shall be adequately supported on insulators to withstand electrical and mechanical stresses due to specified short circuit currents.
- 2.8.2. Busbar cross-section shall be uniform throughout the length of switchgear. Busbars and other high voltage connection shall be sufficiently corona free at maximum working voltage.
- 2.8.3. Contact surfaces at all joints shall be silver plated or properly cleaned and non-oxide grease applied to ensure an efficient and trouble-free connection. All bolted joints shall have necessary plain and spring washers. All connection hardware shall have high corrosion resistance. Bimetallic connectors or any other technically proven method shall be used for aluminum to copper connections.
- 2.8.4. Busbar insulators shall be of arc and track resistant, high strength, non-hygroscopic, non-combustible type and shall be suitable to withstand stresses due to over- voltages, and short circuit current. Busbar shall be supported on the insulators such that the conductor expansion and contraction are allowed without straining the insulators. In case of organic insulator partial discharge shall be limited to 100pico
- 2.8.5. coulomb at rated voltage  $\times 1.1 / 3$  . Use of insulators and barriers of inflammable material such as Hylam shall not be accepted.
- 2.8.6. Successful Bidder shall furnish calculation establishing adequacy of busbar sizes for the specified continuous and short time current ratings.
- 2.8.7. All busbars shall be color coded.
- 2.8.8. The temperature of the busbar and all other equipment, when carrying the rated current continuously shall be limited as per the stipulations of relevant Indian Standards, duly considering the specified ambient temperature (50 deg. C). The temperature rise of the horizontal and vertical busbars when carrying the rated



current shall in no case exceed 55 deg. C for silver plated joints and 40 deg. C for all other type of joints. The temperature rise at the switchgear terminals intended for external cable termination shall not exceed 40 deg. C. Further the switchgear parts handled by the operator shall not exceed a rise of 5 deg. C .The temperature rise of the accessible parts / external enclosure expected to be touched in normal operation shall not exceed 20 deg.C.

## **2.9. EARTHING AND EARTHING DEVICES**

- 2.9.1. A copper / galvanized steel earthing bus shall be provided at the bottom and shall extend throughout the length of each switch board. It shall be bolted/ welded to the framework of each panel and each breaker earthing contact bar.
- 2.9.2. A copper / galvanized steel earthing bus shall be provided at the bottom and shall extend throughout the length of each switch board. It shall be bolted/ welded to the framework of each panel and each breaker earthing contact bar.
- 2.9.3. The earth bus shall have sufficient cross section to carry the momentary short-circuit and short time fault currents to earth as indicated under switchgear parameters without exceeding the allowable temperature rise.
- 2.9.4. Suitable arrangement shall be provided at each end of the earth bus for bolting to Employer's earthing conductors. All joint splices to the earth bus shall be made through at least two bolts and taps by proper lug and bolt connection.
- 2.9.5. All non-current carrying metal work of the switchboard shall be effectively bonded to the earth bus. Electrical continuity of the whole switchgear enclosure frame work and the truck shall be maintained even after painting.
- 2.9.6. The truck and breaker frame shall get earthed while the truck is being inserted in the panel and positive earthing of the truck and breaker frame shall be maintained in all positions i.e. SERVICE and ISOLATED as well as throughout the intermediate travel. The truck shall also get and remain earthed when the control plug is connected irrespective of its position.
- 2.9.7. All metallic cases of relays, instruments and other panel mounted equipment shall be connected to earth by independent stranded copper wires of size not less than 2.5 sq. mm. Insulation colour code of earthing wires shall be green. Earthing wires shall be connected to terminals with suitable clamp connectors and soldering shall not be acceptable. Looping of earth connections which would result in loss of earth connection to other devices, when a device is removed is not acceptable. However, looping of earth connections between equipment to provide alternative paths of earth bus is acceptable.
- 2.9.8. VT and CT secondary neutral point earthing shall be at one place only on the terminal block. Such earthing shall be made through links so that earthing of one secondary circuit may be removed without disturbing the earthing of other circuits.



- 2.9.9. Separate earthing trucks shall be provided by the Contractor for maintenance work. These trucks shall be suitable for earthing the switchgear busbars as well as outgoing / incoming cables or busducts. The trucks shall have a interlock to prevent earthing of any live connection.
- 2.9.10. As an alternative to separate earthing trucks the Bidder may also offer built-in earthing facilities for the busbars and outgoing / incoming connections, in case such facilities are available in their standard proven switchgear design. The inbuilt earthing switches shall have provision for short circuiting and earthing a circuit intended to be earthed. These switches shall be quick make type, independent of the action of the operator and shall be operable from the front of the switchgear panel. These switches shall have facility for padlocking in the earthed condition.
- 2.9.11. Interlocks shall be provided to prevent:
- 2.9.12. Closing of the earthing switch if the associated circuit breaker truck is in Service position.
- 2.9.13. Insertion of the breaker truck to Service position if earthing switch is in closed position.
- 2.9.14. Closing of the earth switch on a live connection.
- 2.9.15. Energizing an earthed Section: Complete details of arrangement offered shall be provided during detailed engineering, describing the safety features and interlocks.
- 2.9.16. The earthing device (truck / switch) shall have the short circuit withstand capability equal to that of associated switchgear panel.
- 2.9.17. All hinged doors shall be earthed through flexible earthing braid.

## **2.10. PAINTING**

All sheet steel work shall be pretreated, in tanks, in accordance with IS: 6005. Degreasing shall be done by alkaline cleaning. Rust and scales shall be removed by pickling with acid. After pickling, the parts shall be washed in running water. Then these shall be rinsed in slightly alkaline hot water and dried. The phosphate coating shall be "Class-C" as specified in IS: 6005. The phosphated surfaces shall be rinsed and passivated. After passivation, Electrostatic Powder Coating shall be used. Powder should meet requirements of IS 13871 (Powder coating specification). Finishing paint shade for complete panels excluding end covers shall be RAL9002 & RAL5012 for extreme end covers of all boards, unless required otherwise by the Employer. The paint thickness shall not be less than 50 microns. Finished parts shall be suitably packed and wrapped with protective covering to protect the finished surfaces from scratches, grease, dirt and oil spots during testing, transportation, handling and erection.



## **2.11. INSTRUMENT TRANSFORMERS**

- 2.11.1. All current and voltage transformers shall be completely encapsulated cast resin insulated type, suitable for continuous operation at the ambient temperature prevailing inside the switchgear enclosure, when the switchboard is operating at its rated load and the outside ambient temperature is 50 deg. C. The class of insulation shall be E or better.
- 2.11.2. All instrument transformers shall withstand the power frequency and impulse test voltage specified for the switchgear assembly. The current transformer shall further have the dynamic and short time ratings at least equal to those specified for the associated switchgear and shall safely withstand the thermal and mechanical stress produced by maximum fault currents specified when mounted inside the switchgear for circuit breaker modules.
- 2.11.3. The parameters of instrument transformers specified in this specification are tentative and shall be finalized by the Employer in due course duly considering the actual burden of various relays and other devices finally selected. In case the Bidder finds that the specified ratings are not adequate for the relays and other devices offered by him, he shall offer instrument transformer of adequate ratings and shall bring out this fact clearly in his Techno commercial bid.
- 2.11.4. All instrument transformers shall have clear indelible polarity markings. All secondary terminals shall be wired to separate terminals on an accessible terminal block.
- 2.11.5. Current transformers may be multi or single core and shall be located in the cable termination compartment. All voltage transformers shall be single phase type. The bus VTs shall be housed in a separate panel on a truck so as to be fully withdrawable. At 33kV main pooling switchgear, Bus VTs panels and line VTs in outgoing feeders shall be provided. All other switchgear location, at outgoing feeder cable charge indication shall be provided based on voltage sensing or use of voltage transformer.
- 2.11.6. All voltage transformers shall have suitable current limiting fuses on both primary and secondary sides. Primary fuses shall be mounted on the withdrawable portion. Replacement of the primary fuses shall be possible with VT truck in isolated position. The secondary fuses shall be mounted on the fixed portion and the fuse replacement shall be possible without drawing out the VT truck from service position.
- 2.11.7. All voltage transformers shall be designed and manufactured for 0.8 Tesla operating point on B-H curve. VT shall be fully insulated type (i.e. double pole construction and neutral side fully insulated to rated BIL). VT shall be manufactured without any joint in secondary winding.

## **2.12. SURGE ARRESTOR**

- 2.12.1. The surge arrestors shall be provided as per tender SLD/ as per system



requirement and shall be of metal oxide, gapless type generally in accordance with IEC 60099-4 and suitable for indoor duty. These shall be mounted within the switchgear cubicle between line and earth, preferably in the cable compartment. Surge arrestor selected shall be suitable for un-earthed system and rating shall be in such a way that the value of steep fronted switching over voltage generated at the switchgear terminals shall be limited to the requirements of switchgear.

### **2.13. CONTROL SUPPLY AND SPACE HEATER SUPPLY**

- 2.13.1. Each switchboard shall be provided at least two (02) Nos of DC feeders for the control supply. In case two DC sources are provided, then suitable rated blocking diodes in both circuit has to be provided. Alternately Bidder can provide source selection switch.
- 2.13.2. One suitable rated 240V single phase AC supply feeder per switchboard / Switchboard section for space heater supply. Bidder shall provide necessary switch and fuse to receive, isolate and distribute to each panel.
- 2.13.3. Each sub circuit shall have separate fuses. Fuse size shall be determined so as to achieve selective clearance between main circuit and sub circuit in case of fault. Potential circuits for protection and metering shall also be protected by separate fuse.
- 2.13.4. All fuses shall be of link type conforming to IS: 13703 / 9385 mounted on suitable fuse bases. Fuses shall have operation indicators for indicating blown fuse condition. Fuse carrier base shall have imprints of the fuse rating and voltage. All accessible live connection to fuse bases shall be adequately shrouded.
- 2.13.5. All DC circuits shall be fused on both poles. Single phase AC circuits shall have fuses on line and link on neutral.
- 2.13.6. DC and AC supply monitoring relay shall be provided and alarm shall be generated in SCADA system in case of failure of supply.

### **2.14. SPACE HEATER**

- 2.14.1. Each switchgear panel shall be equipped with thermostatically controlled space heater(s), suitably located in breaker and cable compartments to prevent condensation within the enclosure. The space heater shall be connected to 240V single phase AC auxiliary supply available in the switchgear, through switches and fuses provided separately for each panel. A 240V single phase 50 Hz AC plug point shall be provided in the interior of each cubicle with ON-OFF switch for connection of hand lamp.

### **2.15. TERMINAL BLOCKS**

- 2.15.1. Terminal blocks shall be 650V grade, 10Amps rated, made up of unbreakable



polyamide 6.6 grade. The terminals shall be screw type or screw-less (spring loaded) / cage clamp type with lugs. Marking on terminal strips shall correspond to the terminal numbering in wiring diagrams. All metal parts shall be of non-ferrous material. In case of screw type terminals the screw shall be captive, preferably with screw locking design.

- 2.15.2. Terminal blocks for CT and VT secondary leads shall be of stud type, made up of unbreakable polyamide 6.6 grade. They shall be provided with links to facilitate testing, isolation star / delta formation and earthing. Terminal blocks for CT secondary shall have the short circuiting facility. The terminals for remote ammeter connection etc. shall also be disconnecting type only. All metal parts shall be of non-ferrous material. Screws shall be captive.
- 2.15.3. At least 10% spare terminals for external connections shall be provided on each panel and these spare terminals shall be uniformly distributed on all terminal blocks. Space for adding another 10% spare terminals shall also be available in each panel.
- 2.15.4. There shall be minimum clearances of 250 mm between the terminal blocks and the cable gland plate and 150 mm between two rows of terminal blocks.
- 2.15.5. All panel wiring for external connections shall terminate on separate terminal blocks which shall be suitable for connecting two (2) stranded copper conductors of 2.5 sq. mm on each side, or alternatively, the terminal blocks shall have the possibility of double shorting space to facilitate looping.

## **2.16. SWITCHGEAR WIRING**

- 2.16.1. All Switchgear panels shall be supplied completely wired internally upto the terminal block ready to receive Employer's external cabling. All inter cubicle wiring and connections between panels of same switchboard including all bus wiring for AC and DC supplies shall be provided / done by the Contractor.
- 2.16.2. All internal wiring shall be carried out with 650 V grade, single core, 1.5 sq. mm. stranded copper wires having minimum of seven strands per conductor and color coded, PVC insulation. CT circuits shall be wired with 2.5 sq. mm. wires which otherwise are similar to the above. Extra flexible wires shall be used for wiring between fixed and moving parts such as hinged doors.
- 2.16.3. All wiring shall be properly supported neatly arranged, readily accessible and securely connected to equipment, terminals and terminal blocks. Wiring troughs or gutters be used for this purpose.
- 2.16.4. Internal wire terminals shall be made with solderless crimping type tinned copper lugs which shall firmly grip the conductor. Insulation sleeves shall be provided over the exposed parts of lugs.
- 2.16.5. Printed single tube ferrules marked to correspond with panel wiring diagram shall be fitted at both ends of each wire. The wire identification marking shall be in accordance with IS: 375. Red Ferrules should be provided on trip circuit



wiring.

- 2.16.6. Interconnection to adjacent panels shall be brought out to a separate set of terminal blocks located near the slots or holes, meant for the interconnecting wires. Arrangement shall permit neat layout and easy interconnections to adjacent panels at site and wires for this purpose shall be provided by Contractor looped and bunched properly inside the panels.
- 2.16.7. Contractor shall be fully responsible for the completeness and correctness of the internal wiring and for the proper functioning of the connected equipment.
- 2.16.8. The Contractor shall provide the necessary clamps wiring troughs etc. for all wiring in side the switchgear enclosed including the Employer's power and control cables.

## **2.17. POWER CABLE TERMINATION**

- 2.17.1. Cable termination compartment shall receive the stranded Aluminium conductor, XLPE insulated, shielded, armored / unarmored, PVC jacketed, single core / three core, unearthed / earthed grade power cable(s).
- 2.17.2. A minimum clearance of about 600 mm shall be kept between the cable lug bottom ends and gland plates for stress cone formation for XLPE cables. Interphase clearance in the cable termination compartment shall be adequate to meet electrical and mechanical requirement besides facilitating easy connections and disconnection of cables. Dimensional drawing of cable connection compartment showing the location of lug, glands, CTs, gland plates etc. and the electrical clearances available shall be submitted for Employer's approval during detail engineering.
- 2.17.3. Cable termination compartment shall have provision for termination of power cables of sizes as indicated during detailed engineering with removable undrilled gland plates. For all single core cables gland plates shall be of nonmagnetic material. Cable entry shall be from bottom. Any change will be intimated later.

## **2.18. NAME PLATES AND LABELS**

- 2.18.1. Each switch board shall have a name plate for its identification. All enclosure mounted equipment shall be provided with individual engraved name plates for clear equipment identification. All panels shall be identified on front as well as backside by large engraved name plates giving the distinct feeder description along with panel numbers. Back side name plates shall be fixed in panel frame and not on the rear removable cover.
- 2.18.2. Name plate shall be of non-rusting metal or 3-ply lamacoid with white engraved letterings, on black background. Inscriptions and lettering shall be subjected to Employer's approval.
- 2.18.3. Suitable stenciled paint mark shall be provided for identification of all equipment, located inside the enclosure, as well as for door mounted equipment,

from the back side in addition to plastic sticker labels, if provided. These labels shall be located directly by the side of the respective equipment, shall be clearly visible and shall not be hidden by equipment wiring. Labels shall have device number as mentioned in wiring drawings. Type of labels and fixing of labels shall be such that they are not likely to peel off / fall off during prolonged use.

## 2.19. TEST

### 2.19.1. TYPE TESTS

All equipment to be supplied shall be of type tested design. During detailed engineering, the contractor shall submit for Owner's approval the reports of all the following type tests carried out not earlier ten years from the date of bid opening. These reports should be for the test conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client.

A)	Reports of the following type tests carried out on circuit breaker / circuit breaker panels, of each voltage class and current rating shall be submitted.
i)	Short circuit duty test on circuit breaker, mounted inside the panel offered along with CTs , bushing and seperators
ii)	Short time withstand test on circuit breaker, mounted inside panel offered together with CTs, bushings and separators.
iii)	Power frequency withstand test on breaker mounted in side panel.
iv)	Lightning impulse withstand test on breaker mounted in side panel.
v)	Temperature rise test on breaker and panel together. For this test, the test set up shall include three panels with breakers, the test breaker and panel being placed in the centre.
	The adjacent panels shall also be loaded to their rated current capacity. Alternatively the test panel may be suitably insulated at the sides, which will be adjoining to other panels in actual site configuration
vi)	Internal Arc Test as per IEC 62271-200
vii)	Measurement of resistance of main circuit.
viii)	Mechanical operation test.
B)	Short circuit withstand test of earthing device (truck / switch).
C)	Testing to observe compliance to degree of protection, shall be checked for each switch board enclosure and busbar chambers during routine inspection shall be as under. IP -4X: It shall not be possible to insert a one (1) mm. dia steel wire into the enclosure from any direction, without using force. IP-5X: It shall not be possible to insert a thin sheet of paper under gaskets and





	through enclosure joints.
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- However, if the contractor is not able to submit report of the type test(s) conducted not earlier than ten years prior to the date of bid opening, or in the case of type test report(s) are not found to be meeting the specification requirements, the contractor shall conduct all such tests under this contract free of at no additional cost to the owner either at third party lab or in presence of client/owner's representative and submit the reports for approval.
- All acceptance and routine tests as per the specification and relevant standards shall be carried out. Charges for these shall be deemed to be included in the equipment price.
- The type test reports once approved for any projects shall be treated as reference. For subsequent projects of MAHAPREIT, an endorsement sheet will be furnished by the manufacturer confirming similarity and "No design Change". Minor changes if any shall be highlighted on the endorsement sheet.

D) Type test reports for the following tests on the model of the Numerical relays, Ethernet switches shall be submitted for employer's review		
S. No.	TEST ITEMS	Standard
i)	Dimensions of structure and visual inspection	IEC 60297-3-101
ii)	Functional requirements:	Relevant IEC 60255-100 series
	– Steady-state simulation	
	– Dynamic simulation	
iii)	Product safety requirements (including the dielectric tests and thermal short time rating)	IEC 60255-27
iv)	EMC requirements:	IEC 60255-26
	– Emission	
	– Immunity	
v)	Energizing quantities:	
	– Burden	N/A
	– Change of auxiliary energizing quantity	IEC 60255-11
vi)	Contact performance	N/A

vii)	Communication requirements	IEC 61850
viii)	Climatic environmental requirements:	IEC 60068-2-14, IEC 60068-2-1, IEC 60068-2-2, IEC 60068-2-78, IEC 60068-2-30, IEC 60255-27
	- Cold	
	- Dry heat	
	- Change of temperature	
	- Damp heat	
ix)	Mechanical requirements: - Shock	IEC 60255-21-1, IEC 60255-21-2, IEC 60255-21-3
	- Vibration	
	- Bump	
	- Seismic	
x)	Enclosure protection	IEC 60529, IEC 60255-27

Two (2) protected soft copies on CD-ROM of the approved test results shall be furnished with the equipment. These shall include complete reports and results of the routine tests and type tests (if the latter is carried out) on equipment. If the type tests are not conducted, the CDs shall contain copies of the results of type tests carried out on identical equipment earlier.

### 2.19.2.ROUTINE TESTS

- All acceptance and routine tests as per the specification and relevant standards IEC 62271-200 & IEC 62271-100 shall be carried out. Charges for these shall be deemed to be included in the equipment price
- An indicative list of tests / checks is mentioned as QA chapter on HT switchgear. However, the manufacturer is to furnish a detailed Quality Plan indicating the practice and procedure along with relevant supporting documents.

### 2.19.3.COMMISSIONING CHECKS / TESTS

After installation of panels, power and Control wiring and connections, Contractor shall perform commissioning checks as listed below to verify proper operation of switchgear / panels and correctness of all equipment in all respects. In addition, the Contractor shall carry out all other checks and tests recommended by the manufacturers.

#### GENERAL

- a. Check name plate details according to specification.
- b. Check for physical damage

- c. Check tightness of all bolts, clamps and connecting terminals
- d. Check earth connections.
- e. Check cleanliness of insulators and bushings
- f. Check heaters are provided
- g. H.V. test on complete switchboard with CT & breaker in position.
- h. Check all moving parts are properly lubricated.
- i. Check for alignment of busbars with the insulators to ensure alignment and fitness of insulators.
- j. Check for interchange ability of breakers.
- k. Check continuity and IR value of space heater.
- l. Check earth continuity for the complete switchgear board.

### **Circuit Breakers**

- a. Check alignment of trucks for free movement.
- b. Check correct operation of shutters.
- c. Check slow closing operation (if provided)
- d. Check control wiring for correctness of connections, continuity and IR values.
- e. Manual operation of breakers completely assembled.
- f. Power closing / opening operation, manually and electrically at extreme condition of control supply voltage.
- g. Closing and tripping time.
- h. Trip free and anti-pumping operation.
- i. IR values, resistance and minimum pick up voltage of coils.
- j. Simultaneous closing of all the three phases.
- k. Check electrical and mechanical interlocks provided.
- l. Checks on spring charging motor, correct operation of limit switches and time of charging
- m. All functional checks.

### **Current Transformers**

- a) IR value between windings and winding terminals to body.
- b) Polarity tests.
- c) Ratio identification checking of all ratios on all cores by primary injection of current.
- d) Magnetisation characteristics & secondary winding resistance.
- e) Spare CT cores, if any to be shorted and earthed.

### **Voltage Transformers**

- a) Insulation resistance test.
- b) Ratio test on all cores.
- c) Polarity test.
- d) Line connections as per connection diagram.

### **Cubicle Wiring**

- a) Check all switch developments.
- b) It should be made sure that the wiring is as per relevant drawings. All interconnections between panels shall similarly be checked.
- c) All the wires shall be checked for IR value.
- d) Functional checking of all control circuit e.g., closing, tripping interlock, supervision and alarm circuit including proper functioning of component / equipment.
- e) Check terminations and connections.
- f) Wire ducting

**2.20. SPECIFICATION FOR 33KV RING MAIN UNIT**

Each Ring Main Unit shall have all the following major components in addition to the other items required for satisfactory performance of equipment:

- a) Painted MS enclosure with steel base frame for Ring Main Unit suitable for outdoor installation.
- b) 33 KV Ring Main Units, Non-extensible type along with requisite number of electrically operated breakers and manually operated Load break switches and earth switches as per Single line Diagram
- c) Control protection and metering requirements as per system requirement and single line Diagram
- d) Internal cabling for connections between the equipments of Ring Main Unit, lighting & earthing system along with required hardware, gaskets, gland plates etc as required

**2.20.1.CODES AND STANDARDS**

IS: 13118, IEC: 62271-200

**2.20.2.TECHNICAL SPECIFICATIONS**

The equipment shall have the following features:

1. ELECTRICAL SYSTEM PARAMETERS		
i	Nominal system voltage	33 kV
ii	Highest system voltage	36 kV
iii	Rated insulation level	
	i) Impulse with stand voltage with 1.2 / 50 Micro second wave ii) One minute power frequency with stand voltage	170 KV(Peak) 70 KV (RMS)

iv	Rated short circuit breaking capacity at specified site conditions (Minimum)	Short circuit current as per SLD with %age of DC component as per IEC-62271-100 corresponding to minimum operating time with operating conditions specified.
v	Rated short circuit making current (minimum)	2.5 time of short circuit current as per contractor design
vi	Rated short time withstand capacity (Minimum)	As per Contractor detailed design
vii	Rated operating duty cycle	O-3 minute-CO-3 minute – CO
viii	Maximum temperature rise over and ambient temperature of 50 deg.C	As per IEC : 62271-100
<b>2. RMU CONFIGURATION</b>		
i	RMU Configuration	As per SLD
ii	Extensibility	Non extensible type
iii	Load break switch, Circuit breaker & earth switch in RMU panel	All shall be fixed (Non draw out) type
iv	Insulation medium for panel/ bus bar	SF6 gas or Dry air in sealed metallic tank
v	Breakers & load break switches	SF6 gas or Vacuum type (with disconnecter & earth switch)
vi	Internal Arc classified FLR	As per system fault current as per SLD, 1sec
<b>3. RMU CONSTRUCTIONAL FEATURES</b>		
i	RMU Panel type	Metal enclosed panel construction
ii	Service Location	Outdoor
iii	Mounting	Free Standing
iv	Overall enclosure protection	IP54 minimum for MV Switchgear Compartments, Vermin proof
v	Doors	Front access with anti-theft hinge
vi	Covers	Bolted for rear access, with handles. All the accessible bolts / screws shall be vandal proof. One set of required Special tools per RMU shall be in the scope of supply.
vii	Construction	Sheet metal 2 mm thick CRCA/Aluzinc/Stainless Steel (minimum) suitable for outdoor application.
viii	Base frame made of steel for RMU	Raised frame of 300 mm height

ix	Lifting lugs	Four numbers
x	Cable entry	Bottom
xi	Bus bar continuous rated current at designed 50 deg.C ambient temperature	As per system requirement.
xii	Bus bar short time withstand capacity	As per SLD (minimum)
xiii	Maximum temperature rise above reference ambient 50 deg C	In line with Table 3 of IEC694
xiv	Earth bus bar	Aluminum sized for rated fault duty for 1 sec
xv	Cooling arrangement	By natural air (without fan)
xvi	Panel internal wiring	Stranded flexible color-coded PVCinsulated copper wire 1.5 sq mm.(min.), 1100-volt grade
xvii	Gasket	Neoprene rubber
xviii	Marshalling terminal blocks	1.5 Sq mm, Nylon 66 material, screw type + 20% spare in each row of TB.
xix	Padlock facility	Required for all earth switches & all handles
xx	Explosion vents	To ensure operator's safety, design should ensure that gases / flames generated during flash over / blast in any of the compartment, must not come out from the front of RMU. Cable compartment & other compartments of the RMU should withstand Internal arc test for the indicated system fault current.
4. Requirements of sealed housing live parts (RMU SF6 gas chamber)		
i	Enclosure	Stainless steel enclosure, IP67 class
ii	SF6 gas pressure low alarm	To be given
iii	Provision for SF6 gas filling	To be given (For 'sealed for life' design of RMU, this is not applicable)
iv	Provision for SF6 gas pressure measurement	Manometer with non-return valve indication
v	Arc interruption method for SF6 breaker / Load break switch	Puffer type / rotating arc type

vi	Potential free contacts for SF6 gas 1NO +1NC pressure low	1NO +1NC
vii	Electrical Bushing	Bushing should be suitable for replacement at site.
<b>5. LOAD BREAK SWITCH (LOAD BREAK ISOLATOR)</b>		
i	Type	Three poles operated simultaneously by a common shaft
ii	Arc interruption in dielectric medium	SF6 or vacuum
iii	Operating mechanism for close/ open	Manual.
iv	Continuous current rating of LBS at design ambient temperature of 50 deg C	100 Amps minimum or as per system requirement
<b>6. CIRCUIT BREAKER</b>		
i	Type	Three poles operated simultaneously by a common shaft
ii	Arc interruption in dielectric medium	SF6 or vacuum
iii	Operating mechanism	Electrically Operated
iv	Emergency trip / open push button	On panel Front
v	Continuous current rating of Breaker at design ambient temp of 50 deg.C	100 Amps minimum or as per system requirement
vi	Short time withstand capacity	As per SLD
vii	Breaker status auxiliary contact	2NO + 2NC wired to terminal block
viii	Current transformer Ratio	Suggestive rating: 100/1 A or as per requirement Other ratings as per manufacturer's standard may also be adopted. Sufficient space must be provided both in horizontal & vertical directions for mounting of CT's. Additionally, some CAUTION marking (by sticker/ paint) should be there to avoid CT's installation above the screen of cable (i.e. earth potential point.)
ix	CT accuracy class	Protection : 5P20 Metering : 0.5
x	Potential Transformer (PT) ratio and Accuracy Class	33000/ □3 /110/ □3 Accuracy class : 0.5 suitable for converter duty application as mentioned elsewhere in the specification

xi	Protections	Numerical relay as per requirements mentioned elsewhere in the specification. In addition to above Transformer protections like OTI, WTI, Buchholz, and Pressure Relief Valve (PRV) operated shall be suitably integrated in the protection circuit. Any AC/DC auxiliary supply requirement for the RMU shall be arranged as per requirement mentioned elsewhere in the specification.
xii	Relay aux contacts for remote indication	1NO+1NC Potential free wired to TB
xiii	Shunt trip (for door limit switch of enclosure or transformer) as per the adopted voltage	To be wired to terminal blocks
<b>7. EARTH SWITCH</b>		
i	Type	Three poles operated simultaneously by a common shaft
ii	Switching in dielectric medium	Dry air in sealed medium or SF6
iii	Operating mechanism for Close/Open	Manual
iv	Short time withstand capacity	As per SLD
v	Aux contacts	1NO+1NC free wired to TB
vi	LBS Earth Switch close / open	Potential free contacts wired to terminal block
<b>8. INDICATION</b>		
i	Cable charge status indication for all Load Break Switches & CircuitBreaker	Circuit breaker capacitor type voltage indicators with LED on all the phases (Shall be clearly visible in day light)
ii	Spring charge status indication	On front for breaker
iii	Earth switch closed indication (For Each LBS)	front
iv	Load break switch ON/OFF indication	Green for OFF / Red for ON
v	Circuit breaker ON/OFF indication	Green for OFF / Red for ON
vi	Deleted	
vii	CB close / open	Potential free contacts wired to terminal block.



viii	Protection relay operated	Potential free contacts wired to terminal block.
ix	SF6 gas pressure low	Potential free contacts wired to terminal block.
x	Cable fault Direction	Cable Fault passage Indicator
<b>9. RMU OPERATIONAL INTERLOCK</b>		
i	Interlock type	Mechanical
ii	Load break switch & respective earth switch	Only one in 'close' condition at a time
iii	Circuit breaker & respective earth switch	Only one in 'close' condition at a time
iv	Prevent the removal of respective cable covers if load break switch or circuit breaker is 'ON'	Electrical / Mechanical
v	Prevent the closure of load break switch or circuit breaker if respective cable cover is open	Electrical / Mechanical
vi	Cable test plug for LBS/CB accessible only if Earth switch connected to earth	Mechanical
<b>10. MIMIC DIAGRAM, LABEL AND FINISH</b>		
i	On panel front with description of function & direction of operation of handles/buttons	
ii	Mimic diagram (Shall not be preferred with Stickers)	
iii	Operating instruction chart and Do's & Don'ts to be displayed on left / front side of panel enclosure on Al Sheet, duly affixed on panel.	
iv	Name plate on panel front	Fixing by rivet only
v	Material	Anodized aluminum 16SWG / SS
vi	Background	Satin Silver
vii	Letters, diagram & border	Black
viii	Process	Etching
ix	Name plate details	Month & year of manufacture, equipment type, input & output rating, purchaser name & order Number, guarantee period.
x	Labels for meters & indications	Anodized aluminum with white character on black background OR 3 Ply lamicoid.
xi	Danger plate on front & rear side	Anodized aluminum with white letters on red background

xii	Painting surface preparation	Shot blasting or chemical 7 tank Process
xiii	Painting external finish	Powder coated epoxy polyester base grade A, shade - RAL 7032
xiv	Painting internal finish	Powder coated epoxy polyester base grade A, shade - white

### 2.20.3. TESTS OF RMU

- 33 kV Switchgear/Ring Mains Unit shall be of type tested design. During detailed engineering, the contractor shall submit for Owner's approval the reports of all the type tests carried out within last ten years from the date of bid opening. These reports should be for the test conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client.
- However, if the contractor is not able to submit report of the type test(s) conducted within last ten years from the date of bid opening, or in the case of type test report(s) are not found to be meeting the specification requirements, the contractor shall conduct all such tests under this contract at no additional cost to the owner either at third party lab or in presence of client/owners representative and submit the reports for approval.
- All acceptance and routine tests as per the specification and relevant standards shall be carried out. Charges for these shall be deemed to be included in the equipment price.
- The type test reports once approved for any projects shall be treated as reference. For subsequent projects of MAHAPREIT, an endorsement sheet will be furnished by the manufacturer confirming similarity and "No design Change". Minor changes if any shall be highlighted on the endorsement sheet.

## 7. INVERTER TRANSFORMER

### 7.1. DRY TYPE INVERTER TRANSFORMER

Sr. No.	PARAMETERS	INVERTER TRANSFORMER
i)	<b>Type</b>	Epoxy cast resin/resin encapsulated
ii)	<b>Duty, Service &amp; Application</b>	Continuous Solar Inverter application and converter duty (Indoor)
iii)	<b>MVA &amp; Voltage ratio</b>	As per system requirement and SLD.
iv)	<b>Vector group</b>	
v)	<b>Termination &amp; Bushing CT</b>	

<b>vi)</b>	<b>Fault Level &amp; Earthing</b>	
<b>vii)</b>	<b>Tap changer type &amp; range</b>	As per system requirement and SLD. OCTC +/-5% (min.)
<b>viii)</b>	<b>Impedance</b>	As per system requirement and SLD & as per Inverter manufacturer recommendation.
<b>ix)</b>	<b>Number of phases</b>	Three (3)
<b>x)</b>	<b>Type of cooling</b>	<b>AN</b> Transformer shall be provided with suitable ventilation system to ensure the temperature rise limits under most severe condition while in service however all tests and performance guarantee shall correspond to air natural (AN) cooling.
<b>xi)</b>	<b>Bushing rating, Insulation class (Winding &amp; bushing)</b>	As per relevant IS/IEC (However, Inverter Transformer LV side winding & bushing insulation class shall be of at least 3.6 kV)
<b>xii)</b>	<b>Maximum Temperature rise of winding over 50 deg. C ambient. (by resistance method) with Air Natural (AN) cooling.</b>	<b>90</b> deg.C. (class F) <b>115</b> deg.C. (class H)
<b>xiii)</b>	<b>SC withstand time (thermal)</b>	2 sec
<b>xiv)</b>	<b>Noise Level</b>	Not to exceed values specified in NEMA TR-1.
<b>xv)</b>	<b>PD Level (max. Allowable)</b>	10 pc
<b>xvi)</b>	<b>Loading Capability</b>	Continuous operation at rated KVA on any tap with voltage variation of +/-10% corresponding to the voltage of the tap as well as in accordance with IEC60076-12/IS: 6600.

<b>xvii) Flux Density</b>	<p>Not to exceed 1.9 Wb/sq.m. at any tap position with +/-10% voltage variation from voltage corresponding to the tap. Transformer shall also withstand following over fluxing conditions due combined voltage and frequency fluctuations:</p> <p>a) 110% for continuous rating.  b) 125% for at least one minute.  c) 140% for at least five seconds.</p>
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**7.1.1. CODES AND STANDARDS**

Dry type transformers	IS: 11171, IEC 60076-11
Indian Electricity Act 2003 and Indian Electricity Rules, BEE notification & CEA guidelines	

**7.1.2. DESIGN AND CONSTRUCTIONAL FEATURES**

- The core shall be constructed from high grade non-ageing cold rolled grain-oriented silicon steel laminations of M4 grade or better quality. The insulation of core to clamp-plates shall be able to withstand a power frequency voltage of 2 kV (rms) for one (1) minute.
- The transformers shall be housed in a metal protective housing, having a degree of protection of IP-23. In case it is placed outdoor, IP for enclosure shall be minimum IP-42 or higher. Enclosure shall be of a tested quality sheet steel of minimum thickness 2mm & shall also accommodate cable terminations. The housing door shall be interlocked such that it should be possible to open the door only when transformer is off. The enclosure shall be provided with lifting lugs and other hardware for floor mounting. Suitable bi-directional skids with pre-drilled holes shall be provided integral with the enclosure or bi-directional rollers shall be provided with suitable locking arrangement.
- Winding conductor shall be electrolytic grade Copper/ Aluminum. Windings shall be of class F insulation or better. All windings are to be uniformly insulated.
- Transformer HV bushings and LV bushings can be either solid porcelain or epoxy type. Bushing shall be suitable for satisfactory operation in the high ambient temperature inside Bus Duct enclosure (if applicable). LV flange area shall be of non-magnetic material.
- Bushing CTs shall be provided in the LV neutral side of adequate rating for REF protection, WTI, etc (as applicable).
- For Marshalling Box, the sheet steel used shall be at least 1.6 mm thick cold rolled. The box shall be tank mounted type. The degree of protection shall be IP-54 in accordance with IS-13947. Wiring Scheme shall be engraved in a stainless-steel plate with viewable font size and the same shall be fixed inside the Marshalling Box door.

- Transformer shall be provided with suitable ventilation system to ensure the temperature rise limits under most severe condition while in service however all tests and performance shall correspond to air natural cooling.

### **7.1.3. PAINTING**

- The inside of enclosure and accessories (except M. Box) shall be painted with two coats of fully glossy white colour with total DFT of 25 to 60 microns. The external paint colour of transformer & accessories shall be blue corresponding to RAL 5012. The external surface of transformer & accessories shall have two coats of chemical resistant epoxy zinc phosphate primer and two coats of polyurethane finish paint with total DFT of 80 to 150 microns. The internal surface of M.Box shall have two coats of chemical resistant epoxy zinc phosphate primer and two coats of chemical & thermal resistant epoxy enamel white paint with total DFT of 80 to 150 microns.

### **7.1.4. Tests and Inspection**

- In case the bidder/contractor has conducted type test(s) within last ten years, he may submit the type test reports to the owner for waiver of conductance of such type test(s). These reports should be for the tests conducted on the equipment similar to those proposed to be supplied under this contract and test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client.
- In case the Bidder is not able to submit report of the type test(s) conducted within last ten years from the date LOA by MAHAPREIT, or in case the type test report(s) are not found to be meeting the specification requirements, the Bidder shall conduct all such tests under this contract at no additional cost to the Employer and submit the reports for approval
- **Short Circuit Test:-** In case short circuit test has not been conducted or the test report not meeting the specification requirement for the offered transformer manufacturer, Bidder /Sub-vendor shall establish "Ability to withstand the dynamic effects of short circuit "for the offered transformer as per latest IEC 60076-5. The ability to withstand the dynamic effects of short circuit can be established either by performing actual short circuit test or by method of calculation with reference to short circuit tested reference transformer as per IEC-60076-5/Annexure-A&B. Bidder shall choose any one the two options mentioned below:
  - Option-1:- Performing actual short circuit test as Type Test. In order to meet project schedule, Bidder/Sub vendor shall take suitable steps quite in advance to ensure successful conduction of short circuit test within three months' time from date of LOA failing which the offered make of the transformer shall not be considered.
  - Option-2: By theoretical evaluation of the ability to withstand dynamic effect of short circuit based on 'Calculation and Design and Manufacture Consideration'. In this regard the guidelines given in Annexure-A with

applicable tables of the IEC 60076-5 is to be followed. The reference transformer chosen shall be of same application, winding configuration, conductor current density and as per Annexure-B of latest IEC-60076-5.

- Necessary Design document and reference test reports related to theoretical comparative evaluation must be submitted by Manufacturer/Bidder as required by Employer in this case.

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

<b>S. N.</b>	<b>TYPE TESTS# (To be carried out on one transformer of each rating)</b>	
1.	Lightning impulse (Full and chopped wave) test on windings (as per IEC 60076-3) (Not applicable for LV)	✓

2.	Short circuit test (special test) as per IEC 60076-5 (if applicable).	✓
3.	Temperature Rise test at a tap corresponding to maximum losses as per IEC 60076. Gas Chromatography shall be conducted on oil sample taken before & immediately after temp. rise test. Gas analysis shall be as per IS: 9434 (based on IEC: 60567), results will be interpreted as per IS: 10593 (based on IEC: 60599).	✓
4.	Measurement of harmonics of no-load current (special test)	✓
5.	Measurement of acoustic noise level as per NEMA TR-1 (special test)	✓
6.	Tank Vacuum & Pressure Test (as per CBIP norms)	✓

(#) NOTE: -

- i. All the type and special tests shall be conducted after performing Short Circuit Test. If Tank Vacuum & Pressure Test is to be carried out then it shall be conducted before SC test.
  - ii. Inverter Transformer LV winding Di-electric tests (except for lightning impulse test for LV winding) shall be carried out corresponding to levels (as per IEC 60076) for 3.6 kV class.
  - iii. All Type tests should be done as per Employer's approved procedure.
- **Routine / Type Tests (Dry Type Transformers):** Transformer shall be short circuit tested after conducting the routine tests. Rest of the type tests shall be conducted after successful short circuit testing (as applicable). All routine tests in accordance with IS: 11171 shall be carried out on each transformer. And All Type tests should be done as per Employer's approved procedure.

<b>Routine / Type Tests (Dry Type Transformers)</b>		
a.)	Measurement of winding Resistance for each tap position.	Routine
b.)	Measurement of voltage ratio at each taps position.	Routine
c.)	Vector group and polarity check	Routine
d.)	Measurement of impedance voltage/short circuit impedance & load loss at principal tap and extremetaps	Routine
e.)	Measurement of no-load losses and magnetising current at rated frequency and 90%, 100% and 110%rated voltage.	Routine
f)	Measurement of insulation resistance	Routine
g)	Measurement of capacitance and tan delta	Routine
h)	Dielectric Tests	
	1) PF/Separate source AC withstand voltage test.	Routine
	2) Chopped wave lightning impulse voltage test on windings (as per IEC 60076-3) (Not applicable forLV)	Type

	3)	Induced over voltage withstand test	Routine
i)		Partial discharge measurement	Routine
j)		Measurement of iron loss & IR (repeat after induced voltage test)	Routine
k)		Short Circuit test as per IEC (if applicable)	Type
l)		Noise Level Measurement	Type
o)		Temperature rise test as per IEC (HV & LV winding)	Type

### 3. AUXILIARY TRANSFORMER

#### 3.1. TECHNICAL REQUIREMENTS

Sr. No.	DESCRIPTION	AUXILIARY TRANSFORMER (AT)
i)	VA Rating & Quantity	As per system requirement and /or SLD*
ii)	Voltage Ratio (KV)	As per system requirement and / or SLD*
iii)	Duty, Service & Application	Continuous application (Outdoor)
iv)	Winding	TWO
v)	Frequency	50 Hz
vi)	Nos. of Phase	THREE
vii)	Vector Group & Neutral earthing	As per system requirement and /or SLD*
viii)	Cooling	ONAN
ix)	Tap Changer	As per system requirement and /or SLD*
x)	Impedance at 75 <sup>0</sup> C	
	a) Principal Tap	As per system requirement and /or SLD*.
	b) Other Taps	
xi)	Permissible Temperature rise over an ambient of 50 deg C (irrespective of tap)	
	a) Top Oil	35 deg.C
	b) Winding	40 deg.C
xii)	SC withstand time (thermal)	2 sec.
xiii)	Fault Level & Bushing CT	As per system requirement and SLD*
xiv)	Termination	As per system requirement and SLD*
xv)	Bushing rating, Insulation class (Winding & bushing)	As per relevant IS/IEC
xvi)	Noise level	AS PER NEMA TR-1



<b>xvii)</b>	Loading Capability	Continuous operation at rated MVA on any tap with voltage variation of +/-10%, also transformer shall be capable of being loaded in IS: 6600.
<b>xviii)</b>	Flux density	Not to exceed 1.9 Wb/sq.m. at any tap position with +/-10% voltage variation from voltage corresponding to the tap. Transformer shall also withstand following over fluxing conditions due to combined voltage and frequency fluctuations: a) 110% for continuous rating. b) 125% for at least one minute. c) 140% for at least five seconds. Bidder shall furnish over fluxing char. up to 150%
<b>xix)</b>	Air Clearance	As per CBIP

**Note (common for Oil filled and dry type transformer):**

- Auxiliary transformers shall be suitable for 3 phase, 4 wire system with additional LVN bushing for equipment earthing.
- Auxiliary Transformer can be either Oil filled or Dry Type (refer relevant specification. If auxiliary transformer is provided indoor, it shall be necessarily dry type

**3.2. CODES AND STANDARDS**

Transformers	IS:2026, IS:6600
Bushings	IS:2099, IS 3347
Insulating oil	IEC 60296
Bushing CTs	IS:2705
Indian Electricity Act 2003, BEE Guideline & CEA notifications	

**3.3. GENERAL INSTRUCTIONS**

Transformer shall be constructed in accordance to IS: 2026 and IS: 3639 or equivalent to any other international standard. Transformer shall be complete & functional in all respect and shall be in scope of supplier.

The other important construction particulars shall be as below:

- The Transformer tank and cover shall be fabricated from high grade low carbon plate steel of tested quality. The tank and the cover shall be of welded construction and there should be provision for lifting by crane.
- A double float type Buchholz relay conforming to IS: 3637 shall be provided.

- c. Suitable Inspection hole(s) with welded flange(s) and bolted cover(s) shall be provided on the tank cover. The inspection hole(s) shall be of sufficient size to afford easy access to the lower ends of the bushings, terminals etc.
- d. All bolted connections to the tank shall be fitted with suitable oil-tight gaskets which shall give satisfactory service under the operating conditions for complete life of the transformer if not opened for maintenance at site
- e. The transformer shall be provided with conventional single compartment conservator. The top of the conservator shall be connected to the atmosphere through indicating type cobalt free silica gel breather (in transparent enclosure). Silica gel shall be isolated from atmosphere by an oil seal.
- f. Transformer shall have adequate capacity Conservator tank to accommodate oil preservation system and volumetric expansion of total transformer oil.
- g. Transformer shall have Oil Temperature Indicator and Winding temperature Indicator (WTI applicable for transformer above 50 KVA) with accuracy class of +/-2 deg.
- h. For Transformers above 100KVA, 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.
- i. M. 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 20% spare terminals shall be provided on each panel. The gasket used shall be of neoprene rubber. Also Marshalling Box, shall be at least 450 mm above ground level (for transformer above 100 KVA). For transformer above 100 KVA, wiring scheme (TB details) shall be engraved in a stainless steel plate with viewable font size and the same shall be fixed inside the Marshalling Box door.

#### **3.4. Windings**

- a) The bidder shall ensure that windings of all transformers are made in dust proof & conditioned atmosphere.
- b) The conductors shall be of electrolytic grade copper free from scales & burrs.
- c) All windings of the transformers shall have uniform insulation.
- d) Tapping shall be so arranged as to preserve the magnetic balance of the transformer at all voltage ratio.

#### **3.5. Core**

- a) The core shall be constructed from non-ageing, cold rolled, super grain oriented silicon steel laminations equivalent to M4 grade steels or better.

- b) Core isolation level shall be 2 kV (rms.) for 1 minute in air.
- c) Adequate lifting lugs will be provided to enable the core & windings to be lifted.

### 3.6. Insulating oil

**3.7.** No inhibitors shall be used in the transformer oil. The oil supplied with transformers shall be new and previously unused and must conform to following while tested at supplier's premises and shall have following parameters.

S.No.	Property	Permissible values
1.	Kinematic Viscosity, mm <sup>2</sup> /s	<input type="checkbox"/> 12 at 40 <input type="checkbox"/> C <input type="checkbox"/> 1800.0 at (-)30 <input type="checkbox"/> C
2.	Flash Point, <input type="checkbox"/> C	<input type="checkbox"/> 140 <input type="checkbox"/> C
3.	Pour point, <input type="checkbox"/> C	<input type="checkbox"/> (-)40 <input type="checkbox"/> C
4.	Appearance	Clear , free from sediment and suspended matter
5.	Density kg/dm <sup>3</sup> at 20 <input type="checkbox"/> C	<input type="checkbox"/> 0.895
6.	Interfacial Tension N/m at 25 <input type="checkbox"/> C	<input type="checkbox"/> 0.04
7.	Neutralisation value, mgKOH/g	<input type="checkbox"/> 0.01
8.	Corrosive sulphur	Non Corrosive
9.	Water content mg/kg	<input type="checkbox"/> 30 in bulk supply <input type="checkbox"/> 40 in drum supply
10.	Anti-oxidants additives	Not detectable
11.	Oxidation Stability -Neutralization value, mgKOH/g -Sludge, % by mass	<input type="checkbox"/> 1.2 <input type="checkbox"/> 0.8
12.	Breakdown voltage	
	As delivered, kV After treatment, kV	<input type="checkbox"/> 30 <input type="checkbox"/> 70
13.	Dissipation factor, at 90 <input type="checkbox"/> C And 40 Hz to 60 Hz	<input type="checkbox"/> 0.005
14.	PCA content	<input type="checkbox"/> 1%
15.	Impulse withstand Level, kVp	<input type="checkbox"/> 145
16.	Gassing tendency at 50 Hz after 120 min, mm <sup>3</sup> /min	<input type="checkbox"/> 5

### 3.8. Bushings

- Bushing below 52 kV shall be oil communicating type with porcelain insulator.
- No arcing horns to be provided on the bushings.

### 3.9. Bushing CTs

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

- All CT terminals shall be provided as fixed type terminals on the M. Box to avoid any hazard due to loose connection leading to CT opening. In no circumstances Plug In type connectors shall be used for CT.

### **3.10. Valves**

- All valves up to and including 50 mm shall be of gun metal or of cast steel. Larger valves may be of gun metal or may have cast iron bodies.
- Sampling & drain valves should have zero leakage rate.

### **3.11. Gaskets**

- Gasket shall be fitted with weather proof, hot oil resistant, rubberized cork gasket.
- If gasket is compressible, metallic stops shall be provided to prevent over compression.
- The gaskets shall not deteriorate during the life of transformer if not opened for maintenance at site. All joints flanged or welded associated with oil shall be such that no oil leakage or sweating occurs during the life of transformer. The quality of these joints is considered established, only if the joints do not exhibit any oil leakage or sweating for a continuous period of at least 3 months during the guarantee period. In case any sweating / leakage is observed, contractor shall rectify the same & establish for a further period of 3 months of the same. If it is not established during the guaranteed period, the guaranteed period shall be extended until the performance is established.

### **3.12. Neutral Earthing Arrangement**

- Neutral earthing shall be done as per system requirement and SLD. In case of solidly earthed neutral of Transformers, it shall be brought through insulated support from tank to the ground level at a convenient point with 2 nos. copper flat, for connection to ground network (as applicable). Neutral of Transformer if not used should be taken out through bushing and covered by insulating cap.

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

- a) HV Cable boxes shall be of phase segregated air insulated type & shall be of sufficient size to accommodate Employer's cable & termination. Phase segregation shall be achieved by insulating barriers (for 3.3 kV and above side)
- b) Cable boxes shall have bus bars / suitable terminal connectors of adequate size & bolt holes to receive cable lugs. The degree of protection of cable boxes shall be IP 55.
- c) A suitable removable gland plate of non-magnetic material drilled as per the Employer's instruction shall also be provided in the cable box
- d) The support from base for the cable box (for 3.3 kV and above side) shall be of galvanized iron
- e) The contractor shall provide earthing terminals on the cable box, to suit

Employer's GI flat.

- f) The minimum length provided for terminating 33 kV, 11KV & 3.3 KV XLPE cable shall be 1000 mm (for 33 kV) 650 mm (for 3.3 kV and 11 kV) from cable gland plate to the cable lug) for the cable boxes, for 433V side suitable length shall be provided (shall be discussed during detail engineering). The final cable size, number & length of terminating XLPE cable shall be furnished during detailed engineering.
- g) Cable boxes shall be designed such that it shall be possible to move away the transformer without disturbing the cable terminations, leaving the cable box on external supports (as applicable).
- h) Cable boxes shall have removable top cover (for transformer above
- i) 100 KVA) & ample clearance shall be provided to enable either transformer or each cable to be subjected separately to high voltage test.

### 3.14. Tests and Inspection

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



<b>S. N.</b>	<b>TYPE TESTS# (To be carried out on one transformer of each rating)</b>	
1.	Temperature Rise test at a tap corresponding to maximum losses as per IS 2026.	√
2.	Tank Vacuum & Pressure Test (as per CBIP norms)	√

#### 4. DRY TYPE AUXILIARY TRANSFORMERS:

Dry Type Transformer shall be constructed in accordance to IS: 2026, IS: 11171 or equivalent to any other international standard, Indian Electricity Act 2003, BEE Guideline & CEA notifications. Transformer rating and all related technical parameters including tap changer (if applicable) shall be as per system requirement/SLD and relevant standards. Transformer shall be suitable for continuous indoor duty application. Transformer shall be complete & functional in all respect. The other important construction particulars shall be as below.

- a) The transformers shall be housed in a metal protective housing, having a degree of protection of IP-23. The enclosure shall be provided with suitable hardware (as required).
- b) The conductors shall be of electrolytic grade copper free from scales & burrs.
- c) Dry Type Transformer windings shall be of class F insulation or better. Cooling shall be AN.
- d) The core shall be constructed from non-ageing, cold rolled, grain oriented silicon steel laminations (M4 or better).
- e) The fittings/accessories including protection/monitoring device (temperature scanner) generally required for satisfactory operation of the transformer, are to be provided.

#### 5. LT POWER CABLES

LT Power & control cables shall be of minimum 1100 volts grade XLPE / PVC insulated conforming to IS 1554 for utilization voltages less than equal to 415 V.

For cable connecting central inverter and inverter transformer, no. of runs and interconnecting trench, bus bar terminations, lugs shall be provided in such a manner so that no overheating of contacts & terminals encountered. Sufficient space for cabling & termination shall be kept.

##### 5.1. CODES & STANDARDS

All standards, specifications and codes of practice referred to herein shall be the latest editions including all applicable official amendments and revisions as on date of opening of bid. In case of conflict between this specification and those (IS codes, standards, etc.) referred to herein, the former shall prevail. All the cables shall conform to the requirements of the following standards and codes:

IS :1554 - I	PVC insulated (heavy duty) electric cables for working voltages upto and including 1100V.
IS : 3961	Recommended current ratings for cables
IS : 3975	Low carbon galvanised steel wires, formed wires and tapes for armouring of cables.
IS : 5831	PVC insulation and sheath of electrical cables.
IS:7098 (Part -I)	Cross linked polyethylene insulated PVC sheathed cables for working voltages upto and including 1100V.
IS : 8130	Conductors for insulated electrical cables and flexible cords.
IS : 10418	Specification for drums for electric cables.
IS : 10810	Methods of tests for cables.
ASTM-D -2843	Standard test method for density of smoke from the burning or decomposition of plastics.
IEC-754 (Part-I)	Tests on gases evolved during combustion of electric cables.
IEC-332	Tests on electric cables under fire conditions. Part-3: Tests on bunched wires or cables (Category-B).

- The cables shall be suitable for laying on racks, in ducts, trenches, conduits and underground (buried) installation with chances of flooding by water.
- All cables shall be flame retardant, low smoke (FRLS) type designed to withstand all mechanical, electrical and thermal stresses developed under steady state and transient operating conditions as specified elsewhere in this specification.
- If cables are to be laid underground, laying shall be as per latest relevant IS code.
- Copper/aluminium conductor used in power cables shall have tensile strength as per relevant standards. Conductors shall be stranded.
- XLPE insulation shall be suitable for a continuous conductor temperature of 90 deg. C and short circuit conductor temperature of 250 deg C.
- PVC insulation shall be suitable for continuous conductor temperature of 70 deg C and short circuit conductor temperature of 160 deg. C.
- The cable cores shall be laid up with fillers between the cores wherever necessary. It shall not stick to insulation and inner sheath. All the cables, other than single core cables, shall have distinct extruded PVC inner sheath of black colour as per IS: 5831. Single core cables shall have no Inner sheath as per IS: 7098 Part-I

## 5.2. CABLE SELECTION & SIZING

Cables shall be sized based on the following considerations:

- a) Rated current of the equipment
- b) The Maximum Overall Voltage Drop from Module to Inverter Transformer shall be limited to 3% of rated voltage. For all other LT cables, Maximum Voltage drop



shall be limited to 3% of rated voltage.

- c) Short circuit withstand capability.
- i. Fault Current – LT switchgear fault current
  - ii. Actual Fault clearing time subjected to minimum of 120mSec.

For a fuse protected circuit, cable should be sized to withstand the let-out energy of the fuse. For breaker-controlled feeder, cable shall be capable of withstanding the system fault current level for total breaker tripping time inclusive of relay pickup time.

### **5.3. CONSTRUCTIONAL FEATURES FOR LT POWER CABLES**

- KV grade XLPE power cables shall have compacted aluminium/ copper conductor, XLPE insulated, PVC inner-sheathed (as applicable), armoured/ unarmoured, PVC outer-sheathed conforming to IS:7098. (Part-I). Cables which are directly buried shall be armoured.
- 1.1KV grade PVC power cables shall have aluminium/copper conductor (compacted type for sizes above 10 sq.mm), PVC Insulated, PVC inner sheathed (as applicable) armoured/ unarmoured, PVC outer-sheathed conforming to IS:1554 (Part-I).

### **5.4. TESTS**

- Indicative list of tests/checks, Routine and Acceptance tests shall be as per Quality Assurance & Inspection table of LT power and control cables enclosed at relevant section.
- All acceptance and routine tests as per the specification and relevant standards shall be carried out. Charges for these shall be deemed to be included in the equipment price.
- All cables to be supplied shall be of type tested design.
- During detailed engineering, the contractor shall submit for Owner's approval the reports of all the type tests carried out within last ten years from the date of bid opening. These reports should be for the test conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client.
- However if the contractor is not able to submit report of the type test(s) conducted within last ten years from the date of bid opening, or in the case of type test report(s) are not found to be meeting the specification requirements, the contractor shall conduct all such tests under this contract at no additional cost to the owner either at third party lab or in presence of client /owners representative and submit the reports for approval.
- The type test reports once approved for any projects shall be treated as reference. For subsequent projects of MAHAPREIT, an endorsement sheet will be furnished by the manufacturer confirming similarity and "No design Change". Minor changes if any shall be highlighted on the endorsement sheet. The reports for following



type tests shall be furnished:

Sl	Type Test	Remarks
	Conductor	
1.	Resistance test	
	For Armour Wires / Formed Wires	
2.	Measurement of Dimensions	
3.	Tensile Test	
4.	Resistance test	
5.	Wrapping test	
6.	Torsion test	For GS round wires only
7.	Elongation test	For GS wire only
8(a)	Mass& uniformity of Zinc Coating tests	For GS wires/formed wiresonly.
8(b)	Adhesion test	For GS wires/formed wires only
	For XLPE insulation & PVC Sheath	
9.	Test for thickness	
10.	Tensile strength and elongation test before ageing and after ageing	
11.	Ageing in air oven	
12.	Shrinkage test	
13	Hot set test	For XLPE insulation only
14	Water absorption test	For XLPE insulation only
15.	Loss of mass test	For PVC outer sheath only.
16.	Hot deformation test	For PVC outer sheath only.
17.	Heat shock test	For PVC outer sheath only
18.	Thermal stability test	For PVC outer sheath only
19.	Oxygen index test	For PVC outer sheath only
20.	Smoke density test	For PVC outer sheath only
21.	Acid gas generation test	For PVC outer sheath only
22	Flammability test as per IEC-332 Part-3 (Category -B)	For completed cable only
23	Insulation resistance test (Volume Resistivity method)	
24	High voltage test	

## 6. LT CONTROL CABLES

The cables shall be suitable for laying on racks, in ducts, trenches, conduits and under ground (buried) installation with chances of flooding by water.

### 6.1. TECHNICAL SPECIFICATIONS

All cables shall be flame retardant, low smoke (FRLS) type designed to withstand all mechanical, electrical and thermal stresses developed under steady state and transient operating conditions as specified elsewhere in this specification.

- Conductor of control cables shall be made of stranded, plain annealed copper.
- Outer sheath shall be of PVC as per IS: 5831 & grey in colour for control cables. In addition to meeting all the requirements of Indian standards referred to, outer sheath of all the cables shall have the following FRLS properties.
  - a) Oxygen index of min. 29 (as per IS 10810 Part-58).
  - b) Acid gas emission of max. 20% (as per IEC-754-I).
  - c) Smoke density rating shall not be more than 60 % (as per ASTM D- 2843).
- Cores of the cables shall be identified by colouring of insulation. Following colour scheme shall be adopted:
  - 1 core - Red, Black, Yellow or Blue
  - 2 core - Red & Black
  - 3 core - Red, Yellow & Blue
  - 4 core - Red, Yellow, Blue and Black
- For control cables having more than 5 cores, core identification shall be done by numbering the insulation of cores sequentially, starting by number 1 in the inner layer (e.g. say for 10 core cable, core numbering shall be from 1 to 10). The number shall be printed in Hindu-Arabic numerals on the outer surfaces of the cores. All the numbers shall be of the same colour, which shall contrast with the colour of insulation. The colour of insulation for all the cores shall be grey only. The numerals shall be legible and indelible. The numbers shall be repeated at regular intervals along the core, consecutive numbers being inverted in relation to each other. When the number is a single numeral, a dash shall be placed underneath it. If the number consists of two numerals, these shall be disposed one below the other and a dash placed below the lower numeral. The spacing between consecutive numbers shall not exceed 50 mm.
- In addition to manufacturer's identification on cables as per IS, following marking shall also be provided over outer sheath.
  - a Cable size and voltage grade - To be embossed
  - b Word 'FRLS' at every 5 metre - To be embossed
  - c Sequential marking of length of the cable in metres at every one metre -To be embossed / printed
- The embossing shall be progressive, automatic, in line and marking shall be legible and indelible.

## **6.2. CABLE SELECTION & SIZING**

Control cables shall be sized based on the following considerations:

- a. The minimum conductor cross-section shall be 1.5 sq.mm.
- b. The minimum number of spare cores in control cables shall be as follows:

No. of cores in cable	Min. No. of spare cores
2C, 3C	NIL
5C	1
7C-12C	2
14C & above	3

### 6.3. CONSTRUCTIONAL FEATURES FOR LT CONTROL CABLES

- 1.1 kV Grade Control Cables shall have stranded copper conductor and shall be multicore PVC or XLPE insulated, PVC inner sheathed, armoured / unarmoured, FRLS PVC outer sheathed conforming to IS: 1554. (Part-I).

### 6.4. CABLE DRUMS

- a) Cables shall be supplied in non-returnable wooden or steel drums of heavy construction. The surface of the drum and the outer most cable layer shall be covered with water proof cover. Both the ends of the cables shall be properly sealed with heat shrinkable PVC/ rubber caps secured by 'U' nails so as to eliminate ingress of water during transportation, storage and erection. However, For Single core cables upto 6 Sq. mm size, supplier can do alternative packaging of whole Drum/Spool to eliminate ingress of water during transportation, storage and erection. Wood preservative anti-termite treatment shall be applied to the entire drum. Wooden drums shall comply with IS: 10418.
- b) Each drum shall carry manufacturer's name, purchaser's name, address and contract number, item number and type, size and length of cable and net gross weight stenciled on both sides of the drum. A tag containing same information shall be attached to the leading end of the cable. An arrow and suitable accompanying wording shall be marked on one end of the reel indicating the direction in which it should be rolled.

## 7. HT CABLES

### 7.1. CODES & STANDARDS

All standards, specifications and codes of practice referred to herein shall be the latest editions including all applicable official amendments and revisions as on date of opening of bid. In case of conflict between this specification and those (IS : codes, standards, etc.) referred to herein, the former shall prevail. All the cables shall conform to the requirements of the following standards and codes.

- IS:7098 Cross linked polyethylene insulated PVC sheathed cable for
- (Part -II) working voltage from 3.3 KV upto & including 33 KV
- IS : 3961 Recommended current ratings for cables
- IS : 3975 Low Carbon Galvanized steel wires, formed wires and tapes for armoring

of cables.

- IS : 4905 Methods for random sampling.
- IS : 5831 PVC insulation and sheath of electrical cables.
- IS : 8130 Conductors for insulated electrical cables and flexible cords. IS : 10418 Specification for drums for electric cables.
- IS : 10810 Methods of tests for cables.
- ASTM-D -2843 Standard test method for density of smoke from the burning or decomposition of plastics.
- ASTM-D-2863 Standard method for measuring the minimum oxygen concentration to support candle like combustion of plastics.
- IEC-754 (Part-I) Test on gases evolved during combustion of electric cables.
- IEEE-383 Standard for type test of Class IE Electric Cables.
- IEC -332 Tests on Electric cables under fire conditions. Part-3: Tests on bunched wires or cables (category -B)

## **7.2. TECHNICAL REQUIREMENTS**

- The cables shall be suitable for laying on racks, in ducts, trenches, conduits and underground (buried) installation with chances of flooding by water.
- 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 as specified elsewhere in this specification.
- Copper/aluminium conductor used in power cables shall have tensile strength as per relevant standards. Conductors shall be multi stranded.
- XLPE insulation shall be suitable for continuous conductor temperature of 90 deg. C and short circuit conductor temperature of 250 deg C. For single-core armoured cables, the armouring may constitute the metallic part of insulation screening
- The cable cores shall be laid up with fillers between the cores wherever necessary. It shall not stick to insulation and inner sheath. All the cables, other than single core cables, shall have distinct extruded PVC inner sheath of black colour as per IS: 5831. In case of single core cables where there are both metallic screening and armouring, there shall be extruded inner sheath between them.
- The embossing / printing shall be progressive, automatic, in line and marking shall be legible and indelible.
- All cables shall meet the fire resistance requirement as per IEEE - 383 with cable installations made in accordance with 'Flammability Test' and as per Category-B of IEC 332 Part -3.
- Allowable tolerances on the overall diameter of the cables shall be  $\pm 2$  mm maximum over the declared value in the technical data sheets.
- In plant repairs to the cables shall not be accepted. Pimples, fish eye, blow holes etc. are not acceptable.
- The cross-sectional area of the metallic screen strip/tape shall be considered in design calculations.



### **7.3. CABLE SELECTION & SIZING**

HT cables shall be sized based on the following considerations:

- a) Rated current of the equipment
- b) As per protection time grading requirement subject to min. of 0.3 sec. For final power evacuation feeder connecting to the GCP, the time shall be min. 1.0 sec

### **7.4. CONSTRUCTIONAL FEATURES OF 11 KV AND ABOVE GRADE CABLES**

- Cables shall conform to IS: 7098 Part - II. These cables shall have multi- stranded, compacted circular, aluminium conductors, XLPE insulated, metallic screened suitable for carrying the system earth fault current, PVC outer sheathed. The conductor screen and insulation screen shall both be of extruded semiconducting compound and shall be applied along with the XLPE insulation in a single operation of triple extrusion process so as to obtain continuously smooth interfaces. Method of curing for cables shall be "dry curing / gas curing".
- The metallic screen of each core shall consist of copper tape with minimum overlap of 20%. However, for single core armoured cables, the armouring shall constitute the metallic part of the screening.

### **7.5. CABLE DRUMS**

- Cables shall be supplied in non-returnable wooden or steel drums of heavy construction. The surface of the drum and the outer most cable layer shall be covered with water proof cover. Both the ends of the cables shall be properly sealed with heat shrinkable PVC/ rubber caps secured by 'U' nails so as to eliminate ingress of water during transportation, storage and erection. Wood preservative anti-termite treatment shall be applied to the entire drum. Wooden drums shall comply with IS: 10418.
- Each drum shall carry manufacturer's name, purchaser's name, address and contract number, item number and type, size and length of cable and net gross weight stencilled on both sides of the drum. A tag containing same information shall be attached to the leading end of the cable. An arrow and suitable accompanying wording shall be marked on one end of the reel indicating the direction in which it should be rolled.
- The standard length for HT power cables shall be 1000 meter for all single core cables and 750 meters for 3 core cables. The length per drum shall be subjected to a maximum tolerance of +/- 5% of the standard drum length. The Employer shall have the option of rejecting cable drum with shorter lengths. One drum length of each cable size can be of non standard length (not less than 250 meter) so as to match the ordered quantity. For each size, the variance of total quantity, adding all the supplied drum lengths, from the ordered quantity, shall not exceed +/-2% and the payment shall be made based on the actual cable length supplied within this limit.

## **7.6. TYPE, ROUTINE AND ACCEPTANCE TESTS**

- All equipments to be supplied shall be of type tested design. During detailed engineering, the contractor shall submit for Owner's approval the reports of all the type tests as listed in this specification and carried out within last ten years from the date of bid opening. These reports should be for the test conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client.
- All acceptance and routine tests as per the specification and relevant standards shall be carried out. Charges for these shall be deemed to be included in the equipment price
- The type test reports once approved for any projects shall be treated as reference. For subsequent projects of MAHAPREIT, an endorsement sheet will be furnished by the manufacturer confirming similarity and "No design Change". Minor changes if any shall be highlighted on the endorsement sheet.
- All types and sizes of cables being supplied shall be subjected to type tests, routine tests and acceptance tests as specified below and according to relevant standards.

## **8. EARTHING SYSTEM**

### **8.1. GENERAL REQUIREMENTS**

The object of protective earthing system is to provide as nearly as possible a surface under and around a station which shall be at a uniform potential and as nearly zero or absolute earth potential as possible. The purpose of this is to ensure that, in general, all parts of apparatus other than live parts, shall be at earth potential, as well as to ensure that operators and attendants shall be at earth potential at all times. Also by providing such an earth surface of uniform potential under and surrounding the station, there can exist no difference of potential in a short distance big enough to shock or injure an attendant when short-circuits or other abnormal occurrences take place.

Care must be taken for equipment with functional earthing that its service is not disrupted due to undesired disturbances in protective earthing system.

- This specification is intended to outline the requirement of earthing (grounding) for Solar array (DC) side and AC Power block side of Solar PV Project. It is not the intent of the specification to specify all details of design and construction since the bidder has full responsibility for engineering and implementation of earthing system meeting the intent of the specification and functional requirement. Any additional equipment, material, services which are not specifically mentioned herein but are required for successful installation, testing and commissioning of earthing system for safe and satisfactory operation of the plant shall be included under scope of the bidder.
- Earthing requirement for outdoor metering yard/Switchyard has been mentioned



elsewhere in the specification and hence shall be excluded from scope of this chapter unless earthing requirement of metering yard/Switchyard is specifically mentioned in this chapter.

## 8.2. CODES & STANDARDS

The equipment/product furnished for earthing system shall meet the requirements of all the applicable relevant National/International codes and standards or their latest amendment Codes and Standards. Product certification has to be CE/UL/BIS/TUV or equivalent. The relevant codes and standard for earthing system are tabulated below:

IS: 3043	Code of practice for Earthing.
IEEE: 80	IEEE guide for safety in AC substation grounding
IEEE: 837	Standard for qualifying permanent connections used in substation grounding
IS: 2309	Code of Practice for the protection of building and allied structures against lightning.
IS: 802	Code of practice for the use of Structural Steel in Overhead Transmission Line Towers.
IS: 2629	Recommended practice for hot dip galvanizing of iron & steel
IS: 2633	Method for testing uniformity of coating on zinc coated articles
IS: 513	Cold rolled low carbon steel sheets and strips
IS: 6745	Methods for determination of mass of zinc coating on zinc coated iron & steel articles.
IS 2062	HOT ROLLED MEDIUM AND HIGH TENSILE STRUCTURAL STEEL – SPECIFICATION
IS: 4736	Hot-dip Zinc coating for MS Tubes.
IS: 458	Precast Concrete Pipes (With and Without Reinforcement)
UL-467	Grounding and Bonding Equipment
IEC7 62561-	Requirements for earthing enhancing compounds
	CEA regulations for electrical safety-2010
	Indian Electricity Rules/ Indian Electricity Act.

All standards, specifications and codes of practice referred to herein shall be the latest editions including all applicable official amendments and revisions as on date of opening of bid. In case of conflict between this specification and those (codes and standards, etc.) referred to herein, the former shall prevail. All work shall be carried out as per the above standards/ codes as applicable.

The earthing system includes earth electrode, installation of earth electrode in suitable pit size, construction of earth pit with cover for the installation, connection of earth



electrode with equipotential earth bus and connection of equipment to equipotential earth bus.

### **8.3. TECHNICAL DETAILS FOR AC EARTHING SYSTEM**

This section outlines the requirements of protective and functional earthing system to discharge AC fault current to earth and provide equipotential bonding for Transformer, HT and LT Switchgear Panel and other similar electrical equipments, Transformer neutral and shield.

- The Contractor shall furnish the detailed design and calculations as per IEEE 80/IS 3043 for Employer's approval for equipment earthing.
- Contractor shall ensure there at least two earth pits each dedicated for earthing of each Transformer, HT/LT Switchgear panel, transformer neutral, Battery Charger/UPS/Control Panel etc. shall be provided. Earth electrode shall be located near to the equipment and all earth electrodes shall be interconnected with parallel conductor buried in earth surrounding the equipment.
- Earthing system of different locations such as Inverter room/Pooling Switchgear/Sub pooling switchgear/Inverter shelter etc. shall be interconnected in single network with buried conductor of the size 65X8 GS Flat laid at 600 mm depth. Contractor shall submit the calculation based on the system of earth conductor and electrode connected in single network. Location and manner of interconnection shall be approved during detail engineering.
- Bidder shall also interconnect Main Pooling Switchgear earthing/Metering Yard earthing with existing Main Plant Earthing.
- For functional earthing of electronic component such as SCADA, contractor shall provide 1 no. (Min) isolated earth electrode near to the equipment connected with 2 run of copper cable of size not less than 25 sqmm. Contractor shall comply to the recommendation of OEM (Original Equipment Manufacturer) for electronic earthing and electrode can be connected with other earth electrode as per recommendation of OEM.

### **8.4. TECHNICAL DETAIL SOLAR ARRAY (DC) EARTHING**

This section outlines the earthing requirement for discharging DC fault current to earth of Solar PV plant and provide equipotential bonding for Module Mounting Structure (MMS), SMB Mounting structure, Module Frames etc.

- Each Module mounting structure (MMS), SPV Module frames, mounting arrangement for String Monitoring Boxes, Metallic Junction Boxes, Metal frames/Panel, Metallic Pipes of the solar array shall be effectively earthed by two separate and distinct connections to earthing system. Earthing system for solar array shall consist interconnected earth pits electrodes connected by 25X6 GS flat (Min.) or Copper Clad Steel (CCS) earthing Conductor of size not less than 120 SQMM laid at the depth of 600 MM below the ground. Minimum size of riser conductor to connect the structures





to buried earthing conductor and structure to structure in the solar farm shall be 25X3 GS Flat or CCS of Min. 70 SQ MM size.

- Periphery fencing wherever provided shall be earthed at every 100 meter interval with 25X3 GS flat connected with DC or AC side nearest buried earthing conductor.
- Earthing conductor for connection to structure and equipment may be kept on the ground below MMS. However, these conductor shall be laid 300 mm below the ground along the pathway and/or crossing the pathway.
- Equipment and structure in the solar farm shall be earthed in compliance to the IS: 3043 (Code of Practice for Earthing) and Indian Electricity Rules/Acts.
- The Contractor shall furnish the detailed design and calculations for Owner's approval as per IS 3043 to determine the number of earth pit and size of earth conductor. However the no. of earth pit electrodes for the DC earthing shall be as per Clause. 2.0 of Chapter A-2
- Buried earth conductor shall be laid all around periphery of solar array farm. GS flat above the ground for structure earthing shall be connected to the nearest buried conductor or electrode. All the earth electrodes shall be interconnected in single network/mesh and no electrode or group of electrodes shall be isolated/islanded. These electrodes shall be uniformly distributed in the solar farm at maximum practical extent and location of earth electrode shall be approved during detail engineering. A continuous earth path is to be maintained throughout the PV array.
- Connection of DC earthing system and AC earthing system with location and manner of connection shall be approved during detail engineering. Contractor shall submit the design calculation of earthing system of AC and DC side as standalone (no interconnection) system.
- Connection of riser to the structures shall be bolted or welded type. Portion of galvanized structure which undergoes welding at site shall be coated with two coats of cold galvanizing and anti-corrosion paint afterwards.
- Connections between equipment earthing leads and between main earthing conductors shall be of welded type. For rust protection, welds should be treated with red lead compound and afterwards thickly coated with bitumen compound. All welded connections shall be made by electric arc welding.
- Each PV Module frame shall be earthed in accordance with module manufacturer guidelines. In case module frame earthing is to be separately provided, it shall be earthed with minimum 2.5 SQMM flexible copper cable with lug at suitable location of module frame. There shall not be more than 12 nos. of PV modules in single loop of earthing connection to module frame. Both ends of the loop of copper cable for earthing shall be connected with nearest earthed structure or earth conductor.
- Contractor shall seek owner's approval for connecting solar array earth mesh with any other earth mat/earth grid of the solar PV plant.
- Size of earth conductor, nos. of earth pits given in this clause is applicable for solar array earthing only. Relevant method and practice of laying of earthing conductor,

earth pits and riser not mentioned herewith but given elsewhere in this specification is applicable to solar array earthing also.

- Inverter functional earthing (Negative earthing, Anti PID Earthing) shall be carried out as per guideline of OEM. Contractor shall submit complete detail of such earthing from OEM and implement the earthing accordingly.

## 9. PLANT ILLUMINATION SYSTEM

- A comprehensive illumination system shall be provided in the entire project. Each building shall be provided with adequate light fittings, 6A/16A socket, fans, etc. Exhaust fans shall also be provided in toilets, battery room, etc
- 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.

### 9.1. LIGHTING SYSTEM DESCRIPTION for CMCS and inverter/PCS room

**Normal AC Lighting System:** AC lighting system 415V, 3Phase, 4wire, will be fed from lighting panels Control Board (LPs) which in turn will be fed from the lighting distribution boards (LDBs) of AC Switch board MCC.

- 9.2. Emergency AC Lightning System:** The emergency lighting system consisting of 20% of the lights shall be fed from UPS DB or DCDB as per scheme adopted by the EPC bidder. Load of the same has to be considered for UPS/ Battery and charger sizing. Bidder shall provide indoor and outdoor emergency lighting at each inverter room, CMCS, security room and main gate.

### 9.3. Lighting Fixture, Lamps & Accessories

- a) All lighting fixtures and accessories shall be designed for continuous operation for its life under atmospheric conditions existing at site.
- b) AC lighting fixtures and accessories shall be suitable for operation on 240 V, AC, 50 Hz supply with supply voltage variation of +/-10%, frequency variation of +/- 5% and combined voltage and frequency variation (absolute sum ) of 10% DC lighting fixtures and accessories shall be suitable for operation on 220 V, with variation between 190 V & 240 V.
- c) All lighting fixtures shall be complete with lamp(s), lamp holder(s), LED chip assembly, terminal blocks, clamps, locking arrangements, fixing brackets etc. Driver circuit/Control gears shall be provided as applicable / specified. The fixtures shall be fully wired upto terminal block. The internal wiring of the fixtures shall be done with suitable low smoke halogen free thermo-plastic or silicon rubber insulated or fire retardant PTFE copper conductor wires of suitable size and type. Further fuse protection of suitable rating in input side shall also be provided specifically for LED luminaires. However, the normal cross section of conductor shall be not less than 0.5 Sq. mm and minimum thickness of insulation shall be 0.6 mm. The wiring shall be capable of withstanding the maximum temperature to which it will be subjected under

specified service conditions without deterioration and affecting the safety of the luminaire when installed and connected to the supply. All fixing /locking screws, washers, nuts, brackets, studs etc, shall be zinc plated and passivated.

- d) All lighting fixtures shall be provided with an external, brass/GI earthing terminal suitable for connecting 14 SWG, GI earthing wire. All metal or metal enclosed parts of the housing and accessories shall be bonded and connected to the earthing terminal as so to ensure satisfactory earthing continuity through out the fixture
- e) The lighting fixtures shall be designed for minimum glare. The finish of the fixtures shall be such that no bright spots are produced either by direct light source or by reflection
- f) The reflectors shall be manufactured from CRCA sheet steel or aluminium as specified. The aluminium reflectors shall be made of high purity aluminium sheet, polished electrochemically brightened and anodized or proven alternate arrangement of anodizing
- g) Starters shall have bi-metal electrodes and high mechanical strength. Starters shall be replaceable without disturbing the reflector or lamps and without use of any tool. Starter shall have brass contacts and radio interference suppressing capacitor.
- h) LED luminaires body shall such designed that heat sink/heat dissipating housing shall be mounted outside the overall luminaires fixture housing, and shall be suitably clearing the driver circuit. Further for outdoor type LED luminaires, the exposed heat sink shall be suitably designed to avoid dust/foreign particles accumulation on the same.
- i) LED luminaires housing/body shall be pressure die cast aluminium or extruded Aluminium or CRCA as specified alongwith finished powder coating. Care shall be taken in the design that there is no water stagnation anywhere.

#### **9.4. JUNCTION BOXES, CONDUITS, FITTING & ACCESSORIES**

- Junction box for indoor lighting shall be made of fire retardant material. Material of JB shall be Thermoplastic or thermosetting or FRP type.
- Junction boxes for street lighting poles and lighting mast if applicable , shall be deep drawn or fabricated type made of min. 1.6 mm thick CRCA Sheet. The box shall be hot dip galvanized. The degree of protection shall be IP55.
- All switches and receptacles upto 16A shall be modular type. These shall be provided with pre-galvanized/galvanized modular switchbox & plate.
- Conduits, Pipes and Accessories:
- Heavy duty PVC conduits conforming to IS: 9537 Part-III along with various accessories shall be used for indoor wiring in the buildings. These conduits shall be concealed in the wall/floor/roof. However, in PEB's, conduits can be fixed on surface.



- Pull out boxes shall be provided at suitable interval in a conduit run .Boxes shall be suitable for mounting on Walls, Columns, etc. Pull-out boxes shall have cover with screw. Pull out boxes used outdoor shall be weather proof type suitable for IP: 55 degree of protection and those used indoor shall be suitable for IP: 52 degree of protection.

#### **9.5. LIGHTING WIRES**

- Lighting wires shall be 1100 V grade, light duty PVC insulated unsheathed, stranded copper/aluminium wire for fixed wiring installation. colour of the PVC insulation of wires shall be Red, Yellow, Blue and Black for R,Y,B phases & neutral, respectively and white & grey for DC positive & DC negative circuits, respectively. Minimum size of wire shall not be less than 1.5.sq.mm. for copper

#### **9.6. LIGHTING POLES**

- The Street Light system and peripheral lighting shall be designed generally in line with design guidelines. Height of the poles should be chosen so as not to affect working of Solar panels. The poles shall be hot-dip galvanized as per relevant IS2629/ IS2633/ IS4759. The average coating thickness of galvanizing shall be min. 70 micron. The System shall be capable of withstanding the appropriate wind load etc as per IS 875 considering prevailing soil/ site condition considering all accessories mounting on pole.
- The street light poles shall have loop in loop out arrangement for cable entry and light fixture / wiring protected with suitably rated MCB. The luminaries used shall be minimum 32 W with minimum pole height of 2.5 m with 35 m inter-pole spacing for peripheral roads & 50 m for internal roads respectively. No lighting is required for Main plant area except for 33/220 kV Outdoor Switchyard and inverter room. Lighting as per specification shall be provided for solar plant in ash dyke area
- For internal roads, the spacing shall be 50 m with same specification.
- Hot dipped Galvanized with 80 mm thickness hexagonal/Octagonal lighting pole with inbuilt JB shall also be acceptable
- Bidder to provide 20A industrial socket at each 100 meter distance interval at the street light pole

### **10.INSTRUMENTATION AND COMMUNICATION CABLE**

#### **10.1. COMMUNICATION CABLE (Optic Fibre Cable)**

- Optic Fiber cable shall be 8/12 core, galvanized corrugated steel taped armored, fully water blocked with dielectric central member for outdoor /indoor application so as to prevent any physical damage. The cable shall have multiple single-mode or multimode fibers on as required basis so as to avoid the usage of any repeaters. The outer sheath shall have Flame Retardant, UV resistant properties and are to be identified with the manufacturer's name, year of manufacturing, progressive automatic sequential on-line marking of length in meters at every meter on outer

sheath.

- The cable core shall have suitable characteristics and strengthening for prevention of damage during pulling viz. Steel central number, Loose buffer tube design, 4 fibers per buffer tube (minimum), Interstices and buffer tubes duly filled with Thixotropic jelly etc. The cable shall be suitable for maximum tensile force of 2000 N during installation, and once installed, a tensile force of 1000 N minimum. The compressive strength of cable shall be 3000 N minimum & crush resistance 4000 N minimum. The operating temperature shall be -20 deg. C to 70 deg. C.
- All testing of the optic fiber cable being supplied shall be as per the relevant IEC, EIA and other international standards.
- Bidder to ensure that minimum 50% (but not less 4) cores are kept as spare in all types of optical fiber cables
- Cables shall be suitable for laying in conduits, ducts, trenches, racks and underground buried installation.
- Spliced/ Repaired cables are not acceptable.
- Penetration of water resistance and impact resistance shall be as per IEC standard

**10.2. Communication Cable (Modbus)**

- Data (Modbus) Cable to be used shall be shielded type with stranded copper conductor based on VDE 0881 . Cable shall have minimum 2 pair each with conductor size of 0.5 SQMM and core identification shall comply with DIN 47100. Cable shall be flame retardant according to IEC 60332-1-
- or equivalent Standard Surge protection device to be provided shall be approved from UL/CSA or any national/international approved lab

**10.3. Instrumentation Cables**

10.3.1. Common requirement

S No.	Property	Requirement
1.	Voltage grade	225 V (peak value)
2.	Codes and standard	All instrumentation cables shall comply with VDE 0815, VDE 0207, Part 4, Part 5, Part 6, VDE 0816, VDE 0472, SEN 4241475, ANSI MC96.1, IS-8784, IS-10810 (latest editions) and their amendments read along with this specification.
3.	Continuous operation suitability	At 70 deg. C for all types of cables
4.	Progressive automatic on-line sequential marking of length in meters	To be provided at every one meter on outer sheath.

5.	Marking to read 'FRLS	To be provided at every 5 meters on outer sheath
6.	Allowable Tolerance on overall diameter	+/- 2 mm (maximum) over the declared value in data sheet
7.	Variation in diameter	Not more than 1.0 mm throughout the length of cable.
8.	Ovality at any cross-section	Not more than 1.0 mm
9.	Others	<p>a) Durable marking at intervals not exceeding 625 mm shall include manufacturer's name, insulation material, conductor's size, number of pairs, voltage rating, type of cable, year of manufacturer to be provided.</p> <p>b) Cables shall be suitable for laying in conduits, ducts, trenches, racks and underground-buried installation</p> <p>c) Repaired cables shall not be acceptable.</p>
10.	Color	The outer sheath shall be of blueBlue

### 10.3.2. Specific requirement

		<b>Property</b>	<b>Requirement</b>
		Type of Cable	F and G Type cables
<b>A. Conductors</b>			
1.		Cross section area	0.5 sq. mm
2.		Conductor material	High conductivity Annealed bare copper
3.		Colour code	As per VDE-815
4.		Conductor Grade	Electrolytic
5.		No & dia of strands	7x0.3 mm (nom)
6.		No. of Pairs	4,8,12,16,24,48
7.		Max. conductor resistance per Km (in ohm) at 20 deg. C	73.4 (loop)
8.		Reference Standard	VDE 0815
<b>B. Insulation</b>			
1.		Material	Extruded PVC type YI 3

<b>2.</b>		Thickness in mm (Min/Nom/Max)	0.25/0.3/0.35
<b>3.</b>		Volume Resistivity (Min) in ohm-cm	1 x 10 <sup>14</sup> at 20 deg. C & 1x10 <sup>11</sup> at 70 deg. C.
<b>4.</b>		Reference	VDE 0207 Part 4
<b>5.</b>		Core diameter above insulation	Suitable for cage clamp connector
<b>C. Pairing &amp; Twisting</b>			
<b>1.</b>		Single layer of binder tape on each pair provided	Yes
<b>2.</b>		Bunch(Unit formation) for more than 4P	To be provided
<b>3.</b>		Conductor /pair identification as per VDE081	To be provided
<b>D. Shielding</b>			
<b>1.</b>		Type of shielding	Al-Mylar tape
<b>2.</b>		Individual pair shielding	To be provided for F-type cabl
<b>3.</b>		Minimum thickness of Individual pair shielding	28 micron
<b>4.</b>		Overall cable assembly shielding	To be provided
<b>5.</b>		Minimum thickness of Overall cable assembly shielding	55 micron
<b>6.</b>		Coverage Overlapping	100% coverage with 20% overlapping
<b>7.</b>		Drain wire provided for individual shield	Yes (for F-type) Size=0.5 mm <sup>2</sup> , No.of strands=7, Dia of strands =0.3 mm, Annealed Tin coated copper
<b>8.</b>		Drain wire provided for overall shield	Yes. Size=0.5 mm <sup>2</sup> , No.of strands=7,Dia of strands=0.3mm Annealed Tin coated copper
<b>E. FILLERS</b>			
<b>1.</b>		Non-hygroscopic, flame	To be provided

		retardant	
<b>F. Outer Sheath</b>			
<b>1.</b>		Material	Extruded PVC compound YM1 with FRLS properties
<b>2.</b>		Minimum Thickness at any point	1.8 mm
<b>3.</b>		Nominal Thick-ness at any point	>1.8 mm
<b>4.</b>		Resistant to water, fungus, termite & rodent attack	Required
<b>5.</b>		Minimum Oxygen index as per ASTM D-2863	29%
<b>6.</b>		Minimum Temperature index as per ASTM D-2863	250 deg.C
<b>7.</b>		Maximum acid gas generation by weight as per IEC-60754-1	20%
<b>8.</b>		Maximum Smoke Density Rating as per ASTM D-2843	Maximum 60% To be provided (defined as the average area under the curve when the results of smoke density test plotted on a curve indicating light absorption vs. time as per ASTM D-2843)
<b>9.</b>		Reference standard	VDE207 Part 5, VDE-0816
<b>G. Electrical Parameters</b>			
<b>1.</b>		Mutual Capacitance Between Conductors At 0.8 KHz (Max.)	120 nF/km for F type 100 nF/km for G type
<b>2.</b>		Insulation Resistance (Min.)	100 M Ohm/Km
<b>3.</b>		Cross Talk Figure (Min.) At 0.8 KHz	60 dB
<b>4.</b>		Characteristic Impedance (Max) At 1 KHz	320 OHM FOR F-TYPE 340 OHM FOR G-TYPE
<b>5.</b>		Attenuation Figure At 1	1.2 db/km



		Khz (Max)	
<b>H. Complete Cable</b>			
1.		Complete Cable assembly	Shall pass Swedish Chimney test as per SEN-SS 4241475 class F3.
2.		Flammability	Shall pass flammability as per IEEE-383 read in conjunction to this specification
<b>I. Tests</b>			
1.		Routine & Acceptancetests	Refer Type Test requirement of Specification for C & I System
2.		Type tests	
<b>J Cable Drum</b>			
1.		Type	Non-returnable wooden drum (wooden drum to be constructed from seasoned wood free from defects with wood preservative applied to the entire drum) or steel drum.
2.		Outermost layer covered with waterproof paper	Yes
3.		Painting	Entire surface to be painted
4.		Length	1000 m + 5% for up to & including 12 pairs. 500 m +5% for above12 pairs

### 11. ENERGY MANAGEMENT SYSTEM

- Contractor shall provide complete SCADA system with all accessories, auxiliaries and associated equipment and cables for the safe, efficient and reliable operation of entire plant and its auxiliary systems.
- Bidder shall include in his proposal all the Hardware, Software, Panels, Power Supply, HMI, Laser Printer, Gateway, Networking equipment and associated Cable etc. needed for the completeness even if the same are not specifically appearing in these specifications.
- 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



- iii. Control of switchgears and Inverters
  - iv. Display and storage of measured values
  - v. Display and storage of derived/calculated/integrated values
  - vi. Display and Storage of Alarm, Event and Trends
  - vii. Generate, store and retrieve user configurable Sequence of Event (SOE) Reports
  - viii. Generate, store and retrieve user configurable periodic reports. SCADA shall have facility to generate report in MS Excel file Format.
  - ix. ix. Remote monitoring of essential parameters on the web authorised with user id and password using standard modem(Internet connection for transferring data to web shall be taken by Contractor in the name of MAHAPREIT Site for O & M period).
  - x. System self-supervision
- SCADA shall have hardware provision to control (Switch On/Switch Off) all the MV/HV/EHV Breakers and Inverters either in hard or soft signal and shall have facility to control Inverter active and reactive power as per requirement mentioned in respective chapter. SCADA shall also be able to acquire real time Data, Status and Alarm from following equipment included but not limited to as required or offered under the scope of this specification:
    - i. All the MV/HV/EHV Switchgear Equipment (Isolators and Earth Switch/Breakers)
    - ii. Main Incomer and Bus Coupler breaker of LT Panel
    - iii. UPS and Battery charger as approved in detail Engineering
    - iv. Weather Monitoring Equipment
    - v. Multi-function meter
    - vi. Numerical Relay
    - vii. Fire Alarm Panel
    - viii. Tariff Energy Meter
    - ix. Monitoring of inverter's each DC input (current, voltage, power etc.).
    - x. GPS Time Synchronization unit
    - xi. SCADA Hardware, Accessories and Communication link
    - xii. Transformer
    - xiii. Solar Panel Tracker
    - xiv. Power conditioning unit (PCU)/inverter
    - xv. Any other equipment required as per specification
  - Type of signal from equipment (Hard wired or Soft) shall be as per specification of the equipment mentioned in the respective chapter and approved during detail engineering.
  - SCADA shall provide real time performance monitoring according to IEC 61724 standard. In case of conflict between this specification and those (IS codes, standards, etc.) referred to herein, the former shall prevail.

- At main control room/CMCS room, it shall be possible to remove/replace online 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. System design shall ensure that while doing so, undefined signaling and releases do not occur and controller operation in any way is not affected (including controller trip to manual, etc) except that information related to removed module is not available to controller. Further, it shall also be possible to remove/replace any of the redundant controller module without switching off the power to the corresponding rack and this will not result in system disturbance or loss of any controller functions for the other controller. The on-line removal/insertion of controller, I/O modules shall in no way affect the safety of plant and personnel.
- The control system shall provide safe operation under all plant disturbances and on component failure so that under no condition the safety of plant, personnel or equipment is affected. Control system shall be designed to prevent abnormal swings due to loss of Control System power supply, failure of any Control System component, open circuit/short circuit. On any of these failures the controlled equipment/parameter shall either remain in last position before failure or shall come to fully open/close or on/off state as required for the safety of plant/personnel/equipment and as finalized during detailed engineering. System shall be designed such that there will be no upset when Power is restored. This operation shall be demonstrated by vendor during Factory Accepted Test (FAT) in the presence of MAHAPREIT Representative.
- The Control system shall be designed to operate in non-air-conditioned area. However, contractor shall provide a Package/Split AC of suitable capacity decided by load requirement in SCADA room. All the power supply module, Ethernet switches and network accessories for non-air-conditioned area shall be suitable for operating in ambient temperature of 50 Deg C Minimum.

**11.1. PROGRAMMABLE LOGIC BASED CONTROL SYSTEM AT CMCS ROOM:** Bidder has to provide PLC based SCADA at CMCS room as per specification given hereunder. Other requirement related to PLC mentioned elsewhere in this chapter is applicable for PLC to be provided in CMCS. For other locations such as Inverter Room, PLC/ IO modules/RTUs are acceptable.

#### **11.1.1. PLC PROCESSOR**

The processor unit shall be capable of executing the following functions: -

- a) Receiving binary and analog signals from the field and providing command output to MCC/SWGR/Drive etc. through Input / Output modules and operator-initiated commands from HMIS / control panel.
- b) Implementing all logic functions for control, protection and annunciation of the equipment and systems.
- c) Providing supervisory information for alarm, various types of displays, status



information, trending, historical storage of data etc.

d) Performing self-monitoring and diagnostic functions.

11.1.2. PLC unit shall be provided with two processors (Main processing unit and memories) one for normal operation and one as hot standby. In case of failure of working processor, there shall be an appropriate alarm and simultaneously the hot standby processor shall take over the complete plant operation automatically. The transfer from main processor to standby processor shall be totally bump less and shall not cause any plant disturbance whatsoever. In the event of both processors failing, the system shall revert to fail safe mode. It shall be possible to keep any of the processors as master and other as standby. The standby processor shall be updated in line with the changes made in working processor.

11.1.3. The memory shall be field expandable. The memory capacity shall be sufficient for the complete system operation and have a capability for at least 20% expansion in future. Programmed operating sequences and criteria shall be stored in nonvolatile semiconductor memories like EPROM. All dynamic memories shall be provided with buffer battery backup for at least 360 hours. The batteries shall be lithium or Ni-Cd type.

11.1.4. Priority of different commands shall be as follows:

11.1.5. Manual intervention shall be possible at any stage of operation. Protection commands shall have priority over manual commands and manual commands shall prevail over auto commands.

11.1.6. A forcing facility shall be provided for changing the states of inputs and outputs, timers and flags to facilitate fault finding and other testing requirements. It shall be possible to display the signal flow during operation of the program.

## **11.2. HUMAN MACHINE INTERFACE SYSTEM (HMIS)**

HMIS configured around latest state-of-the art servers/Workstations with open architecture supporting OPC /TCP/IP protocols, etc.

- The SCADA shall be OPC version 2.05a compliant and implement a OPC- DA 2.05a server as per the specification of OPC Foundation. All data should be accessible through this OPC server.
- For communicating the generation data of the plant in MAHAPREIT, the SCADA system shall be interfaced/ connected with PI server of MAHAPREIT on OPC Protocol. The details of MAHAPREIT PI server shall be furnished during the detailed engineering.
- Graphical Interface Unit (GIU) / Operator work station (OWS) shall perform control, monitoring and operation of all devices interacting with PLC based control system. Contractor shall provide engineering workstation (EWS) as programming station of the PLC and SCADA. It shall be possible to use same EWS as programming station



and the Human Machine Interface System. SCADA System shall be provided with redundant OWS. Operator shall be able to access all control/information related data under all operating conditions including a single processor and computer failure/hardware failure at CMCS in the HMIS. In addition to a desktop based EWS, vendor shall also provide dedicated portable (laptop) based EWS. All frequently called important functions including major displays shall be assigned to dedicated function keys on a soft keyboard for the convenience of the operator for quick access to displays & other operator functions.

- The SCADA System shall have ability to perform operator functions for each OWS / GIU as a minimum, include Control System operation (A/M selection, raise/lower, set point/bias change, on/off, open/close operation, mode/device selection, bypassing criteria, sequence auto, start/stop selection, drive auto selection, local-remote/other multi-position selection etc.); alarm acknowledge; call all kind of displays, logs, summaries, calculation results, etc.; printing of logs & reports; retrieval of historical data; and any other functions required for smooth operation, control & management of information as finalized during detailed engineering.
- The display selection process shall be optimized so that the desired display can be selected with the minimum no. of operations. Navigation from one display to any other should be possible efficiently through paging soft keys as well as through targets defined on the displays. There should be no limitation on number of such targets.
- 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. Assignment of allowable functions and entry fields shall be on the basis of user profile. 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).
- Wherever Graphical Interface Unit is envisaged, it shall meet the minimum functional requirements of monitoring, operating & controlling the process and displaying information related to process locally. GIU shall be provided with TFT active matrix or LED display and keypad for operation. GIU shall be ruggedly designed to withstand hard environments like high temperature, shock and vibration.
- In addition to GUI Display, one 50 Inch LED display shall be provided at SCADA Room.
- Remote monitoring of essential parameters on the World Wide Web using standard modem and Popular Browser such Chrome/Internet Explorer shall be provided by the vendor. (Internet connection for transferring data to web shall be taken by Contractor in the name of MAHAPREIT Site for O & M period).
- Bidder has to provide suitable hardware DMZ network firewall to restrict



unauthorized access to HMI/ SCADA system.

- SCADA shall have facility to provide real time reporting of alarms and statistical data through SMS and e-mails.

### **11.3. PROGRAMMING FUNCTIONALITIES**

- Programming of the PLC Processor/controller as well as programming of HMIS shall be user friendly with graphical user interface and shall not require knowledge of any specialized language. For example, the programming of PLC shall use either of the following:
  - Flow-chart or block logic representing the instructions graphically
  - Ladder diagrams
- The programming of HMIS (like development and modification of data base, mimics, logs / reports, HSR functionalities etc.) shall also be possible through user-friendly menus etc.
- All programming functionalities shall be password protected to avoid unauthorized modification

### **11.4. SOFTWARE REQUIREMENT**

- All necessary software required for implementation of control logic, operator station displays / logs, storage & retrieval and other functional requirement shall be provided. The programs shall include high level languages as far as possible. 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.
- The Contractor shall provide all software required by the system for meeting the intent and functional/parametric requirements of the specification.
- Industry standard operating system like WINDOWS (latest version) etc. to ensure openness and connectivity with other system in industry.
- SCADA system shall include the following standard protocols as a minimum.
  - a. Modbus (TCP/IP, RTU, ASCII)
  - b. Sub Station Protocol (IEC-61850 and IEC 60870 -5-101/104)
- Any other protocol on which the offered equipment (by Contractor) will communicate with SCADA
- The system shall have user friendly programming language & graphic user interface.
- All system related software including Real Time Operating System, File management software, screen editor, database management software, On line diagnostics/debug software, peripheral drivers software and latest versions of standard PC-based software, Antivirus software and latest WINDOWS based packages (MS Word, Excel and PowerPoint) etc. and any other standard language offered shall be furnished as a minimum.
- All application software for PLC system functioning like input scanning, acquisition, conditioning processing, control and communication and software for operator interface of monitors, displays, trends, curves, bar charts etc. Historical storage and retrieval utility, and alarm functions shall be provided.



- The Contractor shall provide software locks and passwords to Employer’s engineers at site for all operating & application software so that Employer’s engineers can take backup of these software and are able to do modifications at site.

**11.5. INPUT/OUTPUT MODULES**

- The PLC system should be designed according to the location of the input/output cabinets as specified.
- Input Output modules, as required in the Control System for all type of field input signals (4-20 mA, non-changeover/change over type of contact inputs etc.) and outputs from the control system (non changeover/change over type of contact, output signals for energizing interface relays at suitable DC voltage as decided during detail engineering, 4-20 mA output etc.) are to be provided by the Contractor
- Electrical isolation of 1.5kV with optical couplers between the plant input/output and controller shall be provided on the I/O cards. The isolation shall ensure that any inadvertent voltage or voltage spikes (as may be encountered in a plant of this nature) shall not damage or mal-operate the internal processing equipment.
- The Input/output system shall facilitate modular expansion in fixed stages. The individual input/output cards shall incorporate indications on the module front panels for displaying individual signal status.
- Individually fused output circuits with the blower fuse indicator shall be provided. All input/output points shall be provided with status indicator. Input circuits shall be provided with fuses preferably for each input, alternatively suitable combination of inputs shall be done and provided with fuses such that for any fault, fuse failure shall affect the particular drive/equipment system only without affecting other systems. switching of power supply.
- The I/O Module shall have the following features:

a	Power supply monitoring.
b	Contact bounce filtering.
c	Optical isolation between input and output signals with the internal circuits
d	In case of power supply failure or hardware fault, the critical outputs shall be automatically switched to the fail-safe mode. The fail-safe mode shall be finalized during detailed engineering.

- Binary Output modules shall be rated to switch ON/OFF coupling relays of approx. 3 VA. Analog output modules shall be able to drive a load impedance of 500 Ohms minimum.
- Output module shall be capable of switching ON/OFF inductive loads like solenoid valves, auxiliary relays etc. without any extra hardware. All input field interrogation voltage shall be finalized during detail engineering. In case of loss of I/O communication link with the main processing unit, the I/O shall be able to



go to predetermined fail safe mode (to be finalized during detailed engineering) with proper annunciation.

- The single (i.e. non-redundant) binary & analog signal required for control purposes shall be wired as follows:
- All single analog & binary inputs including the limit switches of SWGR check-backs of all drives & information related signals shall be wired to single (i.e. non-redundant) input modules.
- Inputs and Outputs related to each of the redundant drives / equipments shall be wired to separate input and output modules.
- Requirement of Nos. of channel in each type of Module (Analog Input, Analog Output, Binary Input, Binary Output, RTD) and Modbus link at Inverter and main control room shall be calculated based on the Input/output signal list to be submitted by the contractor for approval during detail engineering.

#### **11.6. SYSTEM SPARE CAPACITY**

Over and above the equipment and accessories required to meet the fully implemented system as per specification requirements, Control System shall have spare capacity and necessary hardware/ equipment/ accessories to meet following requirement for future expansion at site:

- 20 % spare channels in input/output modules fully wired up to cabinets TB.
- Wired-in "usable" space for 20% modules in each of the system cabinets for mounting electronic modules wired up to corresponding spare terminals in system cabinets. Empty slots between individual modules/group of modules, kept for ease in maintenance or for heat dissipation requirement as per standard practice of Contractor shall not be considered as wired-in "usable" space for I/O modules. Terminal assemblies (if any in the offered system), corresponding to the I/O modules shall be provided for above mentioned 20 % blank space. Each processor / controller shall have 30% spare functional capacity to implement additional function blocks, over and above implemented logic/ loops. Further, each processor / controller shall have spare capacity to handle minimum 30% additional inputs/ outputs of each type including above specified spare requirements, over and above implemented capacity. Each of the corresponding communication controllers shall also have same spare capacity as that of processor/controller.
- The Data communication system shall have the capacity to handle the additions mentioned above. Twenty (20) percent spare relays of each type and rating mounted and wired in cabinets TB. All contacts of relays shall be terminated in terminal blocks of cabinets.
- The spare capacity as specified above shall be uniformly distributed throughout all cubicles. The system design shall ensure that above mentioned additions shall not require any additional controller/processor/ peripheral drivers in the system





delivered at site. Further, these additions shall not deteriorate the system response time / duty cycle, etc. from those stipulated under this specification.

#### **11.7. DATA COMMUNICATION SYSTEM (DCS)**

- The Data Communication System shall include a redundant Main System Bus with hot back-up. Other applicable bus systems like cubicle bus, local bus, I/O bus etc shall be redundant except for backplane buses which can be non-redundant. The DCS shall have the following minimum features:
  - a) 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.
  - b) 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.
  - c) If the system bus requires a master bus controller philosophy, it shall employ redundant master bus controller with automatic switchover facility.
  - d) 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.
  - e) The design and installation of the system bus shall take care of the environmental conditions as applicable.
  - f) Data transmitting speed shall be sufficient to meet the responses of the system in terms of displays, control etc. plus 25% spare capacity shall be available for future expansion.
  - g) Cat 6 UTP or fiber optic cables shall be employed
- The Contractor shall furnish details regarding the communication system like communication protocol, bus utilization calculations etc.
- Contractor shall setup Gigabit Ethernet based Plant Local Area Network (LAN) to connect to different communication nodes at Inverter /Switchgear location etc. with redundant backbone using ring or better topology. Each Modbus cable shall be provided with Surge protection device at SCADA Panel End. Specification of OFC and Modbus cable has been given elsewhere in this specification.

#### **11.8. HISTORICAL STORAGE AND RETRIEVAL SYSTEM (HSRS)**

- The HSRS shall collect, store and process system data from MMIPIS data base. The data shall be saved online on hard disk and automatically transferred to erasable long term storage media once in every 30 Days periodically for long term storage. Provision shall be made to notify the operator when hard disk is certain percentage

full. The disk capacity shall be sufficient to store at least seven days data.

- 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 & frequency of storage and retrieval shall be as finalised during detailed engineering. The system shall provide user-friendly operator functions to retrieve the data from historical storage. It shall be possible to retrieve the selected data on OWS or printer in form of trend/report by specifying date, time & period. Further, suitable index files/directories shall also be provided to facilitate the same. The logs/reports for at least last thirty (30) days shall be available on the disk.
- In addition to above, the system shall also have facility to store & retrieve important plant data for a very long duration (plant life) on portable long term storage media). These data will include any data from the database as well as processed/computed data based a various calculations/transformation. The retrieved data from long term storage media should be possible to be presented in form of alarms, logs, reports, etc.
- SCADA shall have facility to store long term data, days wise/ weekly/ monthly/yearly for 25 years for analysis and analytical reports to analyze the plant performance (PR) at various levels i.e, SMB, Inverter, Plant. For faster retrieval of long-term aforementioned performance data, contractor shall offer time series data historian of 400 tags minimum for plant capacity upto 50 MW and additional 100 tags for every 10 MW or part above 50 MW however actual nos. of tags shall be determined based on the tag calculation.

#### **11.9. CONTROL & POWER SUPPLY SCHEME**

- Contractor shall provide the DC Power supply of suitable rating to cater all the load requirements of SCADA system and its auxiliaries. The details of UPS and its batteries are mentioned in the respective clause of this specification. The power backup duration for the entire system should be as mentioned in UPS specification. SCADA system shall have two UPS input power supply and one raw power supply. Power supply module used to convert UPS AC power to DC power shall be redundant. it shall be ensured that SCADA system remain in service in case of single UPS power supply failure/power supply module failure. Suitable alarm shall be generated in case of any power supply failure.

#### **11.10. CONTROL CABINETS / PANELS / DESKS AT CMCS ROOM**

- The cabinets shall be IP-22 protection class. The Contractor shall ensure that the packaging density of equipment in these cabinets is not excessive and abnormal temperature rise, above the cabinet temperature during normal operation or air-conditioning failure, is prevented by careful design. This shall be demonstrated to the Employer during the factory testing of the system. The Contractor shall ensure that the temperature rise is limited to
- 10 deg. C above ambient and is well within the safe limits for system components even under the worst condition and specification requirements for remote I/O



cabinets. Ventilation blowers shall be furnished as required by the equipment design and shall be sound proof to the maximum feasible extent. If blowers are required for satisfactory system operation, dual blowers with blower failure alarm shall be provided in each cabinet with proper enclosure and details shall be furnished with proposal. Suitable louvers with wire mesh shall be provided on the cabinet.

- The cabinets shall be designed for front access to system modules and rear access to wiring and shall be designed for bottom entry of the cables for Main control room.
- 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, preferred height of the cabinet shall not higher than 2200 mm. The cabinets shall be equipped with full height front and rear doors. The floor mounting arrangement for other cabinets shall be as required by the Employer and shall be furnished by the Contractor during detailed engineering. Wall mounted cabinet is acceptable for Inverter room/sub- pooling switchgear.
- Cabinet doors shall be hinged and shall have turned back edges and additional braking where required ensuring rigidity. Hinges shall be of concealed type. Door latches shall be of three-point type to assure tight closing. Detachable lifting eyes or angles shall be furnished at the top of each separately shipped section and all necessary provisions shall be made to facilitate handling without damage. Front and rear doors shall be provided with locking arrangements with a master key for all cabinets. If width of a cabinet is more than 800 mm, double doors shall be provided.
- Two spray coats of inhibitive epoxy primer-surface shall be applied to all exterior and interior surfaces. A minimum of 2 spray coats of final finish colour shall be applied to all surfaces. The final finished thickness of paint film on steel shall not be less than 65-75 micron for sheet thickness of 2 mm and 50 microns for sheet thickness of 1.6 mm.

#### **11.11. CONTROL DESK**

- Control desk shall be free standing table top type with doors at the back and shall be constructed of 2 mm thick CRCA steel plates. A 19 mm thick wooden top shall be provided on the desk to keep the TFT monitors at top and computers inside. Control desk shall consist of vertical, horizontal and base supports with their coverings for work surface, keyboard trays, mouse pads, monitor shelf and concealed cable and wire way management, perforated trays with covers in both horizontal and vertical directions. Telephone sets, very few PB stations and lamps shall be mounted on the control desk on mosaic grid structure and same shall be decided during detailed engineering. ASCII Keyboard shall be capable of being pulled out through a tray.



- Each Control Desk shall have two UPS input power supply and one raw power supply. It shall be ensured that Workstation remain in service in case of single UPS power supply failure.
- The cabling / wiring between OWS & CPU'S, power supply cables etc. shall be aesthetically routed and concealed from view.

#### **11.12. FURNITURE**

- Chairs – Industry standard revolving chairs with wheels and with provision for adjustment of height (hydraulically/gas lift) shall be provided for the operators, unit-in-charge & other personnel in control room area ( At least 4 Nos). These shall be designed for sitting for long duration such that these are comfortable for the back. Arm-rests in one piece shall be of poly- urethane and twin wheel castor of glass filled nylon. One Printer Table made of Laminated Wood or Heavy Duty MDF shall be provided for printer. All the furniture shall be of reputed make (Godrej or Equivalent).

#### **11.13. SOFTWARE DOCUMENTATION AND SOFTWARE LISTINGS**

- All technical manuals, reference manuals, user's guide etc., in English required for modification/editing/addition/deletion of features in the software of the PLC System shall be furnished. The Contractor shall furnish a comprehensive list of all system/application software documentation after system organization for Employer's review and approval.
- All The software listings for application software, Project data files etc. shall be submitted by the Contractor.
- All the SCADA Software with license Key shall be handed over to MAHAPREIT on the DVD/CD media. All the hardware and software shall be licensed to MAHAPREIT.

#### **11.14. 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 (e.g. organization or site license) and shall not be hardware/machine-specific. That is, if any hardware/machine is upgraded or changed, the same license shall hold good and it shall not be necessary for Employer to seek a new license/renew license due to up gradation/change of hardware/machine in Contractor's System at site. All licenses shall be valid for the continuous service life of the plant.
- Contractor shall provide licenses as per Cl. 2.0 of Chapter A-2 for remote monitoring of the essential parameters of the plant on the web using popular web browser without requirement of additional software. User ID and password for remote view can only be changed by SCADA Administrator.

#### **11.15. TIME SYNCHRONIZATION**

- The contractor will provide at least one GPS clock, which shall be synchronized with the SCADA system and all devices which are communicating with SCADA shall be synchronized with GPS Clock through SCADA or directly with GPS Clock.

The technical details of GPS have been specified elsewhere in the specification.

**11.16. HMIPIS HARDWARE**

- The HMIPIS as specified shall be based on latest state of the art Workstations and Servers and technology suitable for industrial application & power plant environment.
- The Workstation/Servers employed for HMIPIS implementation shall be redundant based on industry standard hardware and software which will ensure easy connectivity with other systems and portability of Employer developed and third party software.
- Redundant sets of communication controllers shall be provided to handle all the communication between the HMIPIS and redundant system bus and to ensure specified system response time and parametric requirements. Each communication controller shall have message checking facility.
- Power Fail Auto Restart (PFAR) facility with automatic time update shall be provided.
- 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 under HMIPIS 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.

**11.17. FACTORY ACCEPTANCE TEST (FAT)**

- FAT procedure shall be submitted by bidder for MAHAPREIT approval and after approval of FAT procedure, FAT will be witnessed by MAHAPREIT Engineering or authorized representative of MAHAPREIT. SCADA shall communicate with all third-party devices which are part of the Plant and the same shall be demonstrated during the FAT.

**11.18. SUPPLY OF OUTDOOR WIRELESS ACCESS POINT**

- Bidder has to supply 2(two) nos. of Industrial outdoor IEEE 802.11 b/g/n wireless access point with 2x10/100Base-T(X) having Far Distance Air Connectivity up to 7 KM and protection class IP-67. It shall be suitable for pole mount with minimum operating temperature of 55 Deg C.
- These devices shall be used for connectivity of MAHAPREIT existing data communication network with the Plant SCADA. Contractor scope is limited to supply and installation of the devices and MAHAPREIT shall configure and setup the communication.

**11.19. TIME SYNCHRONISATION EQUIPMENT**

- a) Time Synchronization equipments shall be provided and shall be located in the Control Room. It shall receive Coordinated Universal Time (UTC) transmitted through Geo Positioning Satellite (GPS) for time synchronization of all components



of the SCADA.

- b) It shall be complete in all respects including antenna, all cables, processing equipment, etc.
- c) All auxiliary systems and special cables required for synchronization of the equipment shall be supplied and commissioned by the Contractor.
- d) It shall work from DC supplies only and the Contractor to clarify if any built-in battery backup is provided, in which case, same shall be of long-life lithium batteries.
- e) It shall be immune to hostile electrical environment. Suitable protections are to be provided against lightning surges and over-voltages in power supply systems and antenna feeders.
- f) The system shall be fully tested to the relevant international standards such as IEC: 801 and IEC: 255.
- g) All components of the SWYD SAS, including Substation Controllers, Workstations, Bay Control Units (BCU) and Bay Protection units (BPU) and all numeric protection relays as per requirement under this scope of technical specification or offered by bidder shall be synchronized with an accuracy of 1ms.
- h) The GPS shall be synchronized with the SCADA system to be supplied under this contract and all devices which are communicating with SCADA shall be synchronized with GPS. Necessary software and Hardware (including laying of communication cable) required for time synchronization with SCADA and all other devices shall be in scope of contractor.
- i) The system should be able to track more than 1 satellite at a time to ensure no interruptions of synchronization signals.
- j) These output ports shall be compatible with the requirement of the equipment to be synchronized i.e. BCUs and BPUs. The master clock in control room shall also be synchronized with the time synchronization system. The actual port requirements (no./type) in line with the system offered shall be finalized during detailed engineering.
- k) The equipment should have a periodic time correction facility of one-sec. periodicity. The equipment shall also have real time display in hour, minute, second (24 hour mode) and have a separate time display, having display size of approx. 144mm height.
- l) Technical specification for Network Firewall:

Technical Requirements for Network Firewall		
S No	Feature	Required parameter
A	General	

A1	Common Criteria Certification.	The offered product series or its operating system series must have achieved EAL (Evaluation Assurance Level) Certification of EAL4 or higher in the Common Criteria for Information Technology Security Evaluation (ISO/IEC 15408) for computer security certification.
A2	Architecture	The firewall should be a purpose built hardware appliance based next generation firewall (NGFW) solution having application awareness & Intrusion prevention function.
A3	End of sale	OEM End-of-sale declaration shall not have been released for the offered model at the time of the bid submission.
<b>B.</b>	<b>Hardware Specifications &amp; Performance Parameters</b>	
B1	Firewall Interfaces	Minimum <b>Four or AS REQUIRED</b> Nos of gigabit 10/100 base T Ethernet ports to be provided.
		Provision of addition of at least Two Nos of gigabit Fiber SFP ports shall be available.
		Each Port must be configurable flexibly in any security zone as per the requirement without any fixed zone assignments.
		All the above specified interfaces shall be firewall interfaces. Internal Switch interfaces shall not be considered.
		The Firewall shall NOT have any wireless interfaces.
B2	Security Zones	At least four Security zones must be supported.
<b>C</b>	<b>Firewall Inspection</b>	
C1	Application Support for Inspection	Should support standard protocols
		Internet based applications like Telnet, FTP, SMTP, http, DNS, ICMP etc. should be supported for filtering
		Internet web 2.0 applications & widgets.
C2	NAT & PAT	Dynamic NAT as well as one to one NAT
		Port / IP Address Forwarding
		PAT
C3	Resistance to Evasion	The firewall shall be able to detect and block evasion techniques including SYN flood, Address spoofing and TCP split handshake etc.
<b>D</b>	<b>Application awareness</b>	
		Firewall should support detection regardless of application of port, protocol etc.

D1	Application intelligence control and	<p>firewall must identify and control applications sharing the same session</p> <p>The firewall should allow creation of security policies to identify, allow, block or limit an application regardless of port, protocol etc.</p>
<b>E Intrusion Prevention System (Integrated with firewall)</b>		
E1	General	<p>The IPS must provide intrusion prevention functionality out of the box.</p> <p>The IPS should be capable of accurately detecting intrusion attempts and discern between the various types and risk levels, including unauthorized access attempts, pre-attack probes, suspicious activity, vulnerability exploitation etc</p> <p>The IPS should provide protection from Advanced Botnets, inbound and outbound.</p> <p>The IPS should use stateful detection and prevention techniques and provide zero-day protection against worms, Trojans, spyware, keyloggers, and other malware from penetrating the network.</p>
E2	Detection Methods	<p>The offered solution should use the following methods for detection of malicious traffic:</p> <p>(a) Signature based detection</p> <p>(b) Statistical Anomaly based detection</p>
E3	Threat Intelligence and signature Updates	The IPS OEM should have a 24x7 security service update and should support real time signature update of the system as soon as updates are released.
E4	Exception List	The IPS should support the creation of Access Control Lists to bypass the inspection of any specific flow.
E5	DoS/ DDoS protections	The offered solution should be capable of preventing Denial of Service and Distributed denial of service attacks.
E6	Threat control features	<p>The offered solution should provide the following Security features:</p> <p>a) Detection and blocking malicious web traffic on any port.</p> <p>c) Capability of detecting attacks within protocols independent of port used</p> <p>d) IPS Sensor should allow the admin to create IPS policies on the basis of IP addresses and range.</p>
E7	Signature Tuning	The offered solution should allow enabling/disabling of each individual signature. Each signature should allow granular tuning to





		suit user requirement.
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**12.AUXILIARY POWER SYSTEM SUPPLY**

**12.1. GENERAL**

- Auxiliary power supply arrangement shall be in line with tender SLD. Each Inverter Room/local pooling/sub-pooling/CMCS room shall have its own auxiliary power supply system comprising of AC distribution board (ACDB) which shall be fed from LV side of Inverter transformer through suitably rated auxiliary transformers. All ACDB's shall have two incomer (100% rated) fed from two different sources. At CMCS, auxiliary transformer directly feed from 33kV switchgear are also acceptable. Following consideration shall be taken while arriving kVA capacity of auxiliary transformer:
  - 20% design margin.
  - The minimum kVA capacity of auxiliary transformer CMCS requirement shall be 50kVA.
- All non-critical auxiliary loads shall be fed directly from ACDB. However, emergency and important load shall be fed from suitable sized Uninterrupted Power Supply (UPS) or Battery Charged. Input AC supply for Uninterrupted Power Supply (UPS) and Battery Charger shall be fed from ACDB. Bidder shall consider the following one of the supply option for feeding different equipment loads:

SI No	Equipment Name	Option-1 ACDB	Option-2 UPS	Option-3 Battery charger
1.	SCADA including remote RTU/IO panel		<input type="checkbox"/>	<input type="checkbox"/>
2.	SCADA HMI		<input type="checkbox"/>	<input type="checkbox"/>
3.	Data logger		<input type="checkbox"/>	<input type="checkbox"/>
4.	Fire Detection /Alarm Panel		<input type="checkbox"/>	<input type="checkbox"/>
5.	Emergency Lighting		<input type="checkbox"/>	<input type="checkbox"/>
6.	CCTV (if applicable)		<input type="checkbox"/>	<input type="checkbox"/>
7.	HMI of SCADA		<input type="checkbox"/>	<input type="checkbox"/>
8.	Inverter's Auxiliary supply (if applicable)		<input type="checkbox"/>	<input type="checkbox"/>
9.	Energy Meter/MFM		<input type="checkbox"/>	<input type="checkbox"/>
10.	Sub and Local Pooling Switchgear control & protection		<input type="checkbox"/>	<input type="checkbox"/>
11.	Main Pooling Switchgear (CMCS) control & protection			<input type="checkbox"/>
12.	Switchgear spring charging motor		<input type="checkbox"/>	<input type="checkbox"/>
13.	switchgear space heater	<input type="checkbox"/>		

14.	Illumination, Fan supply etc	<input type="checkbox"/>		
15.	Module washing system	<input type="checkbox"/>		
16.	Other non-critical auxiliary loads	<input type="checkbox"/>		

- UPS system shall comprise of 2 x 100% UPS. Each UPS shall consist of 1x100% charger and inverter, 1 x 100% Battery bank for providing 30 minutes backup. Bypass Line static switch, manual bypass switch, 1 x 100% UPSDB, and other necessary Protective devices and accessories. UPSDB shall have two incomer fed from two separate UPS as mention above. At a time one incomer shall be in service. Suitable auto changeover logic shall be provided. In place of UPS , bidder can provide DC supply system (2 x 100% Battery Charger) of 12V or above upto 220V DC if the auxiliary power supply requirement of loads are in DC.
- The rated AC output capacity shall be taken for UPS battery size calculation. However the minimum UPS rating shall be 2KVA and the battery sizing shall be calculated on a minimum load of 1 KW (DC) for 30 minute backup. All UPS having rating 5KVA or more shall have three phase input.
- The Bidder can provide alternate arrangement with suitable redundancies such as power pack with 30 minute backup for switchgears.
- Each Battery charger system shall consist of 1 x 100% charger and 1 x 100% Battery bank for min 30 minutes back up and 1 x 100% DCDB, and other necessary protective devices and accessories. DC supply system voltage shall be 12V or above upto 220V DC.
- It is mandatory to use Battery charger system for control and protection supply of main pooling HT switchgear.
- Bidder shall submit configuration diagram, power supply distribution scheme, single line diagram and data sheets, all calculations such as Rectifier Modules/UPS Charger/Inverter rating calculations, battery sizing calculation etc. for UPS, Battery Charger & Battery system during detailed engineering stage for employer's review and approval.
- Size and rating of UPS, Battery Charger and Battery shall be finalized during details engineering stage.

**12.2. UNINTERRUPTIBLE POWER SUPPLY (UPS) SYSTEM**

- The minimum capacity of the UPS at load factor of 0.8 lagging inclusive of 10% design margin at 50 deg C. The UPS shall have an overload capacity of 125 % rated capacity for 10 minutes and 150 % rated capacity for 10 seconds. The overall efficiency of UPS shall be at least 80% on full load.
- The UPS system shall be capable of operating without D.C. battery in circuit under all conditions of load and the performance of various components of UPS like inverter, charger, static switch etc. shall be guaranteed without the battery in circuit.
- For UPS capacity 5 kVA or more, in addition to indications/display on UPS panel, important alarms along with important analog signal shall also be provided for



use in SCADA. For UPS capacity less than 5 kVA bidder shall provide status, common alarm and trip DI (soft or hard) signal to SCADA

- The UPS chargers shall be self-regulating, solid state silicon controlled, full-wave rectifier type designed for single and parallel operation with battery and shall have automatic voltage regulators for close voltage stability even when AC supply voltage fluctuates. The charger should be capable to fully charge the required batteries as well as supply the full rated load through inverter. The charger shall be able to re-charge the fully discharge battery within 8 hours. The charger shall be design for input supply variation of  $\pm 10\%$  and frequency variation of  $\pm 5\%$ . Charger design shall ensure that there is no component failure due to fluctuations of input supply or loss of supply and restoration. The detailed specification for the battery charger for UPS rating of 5kVA and above has been mentioned in the battery charger section below in this specification.
- The UPS inverter shall be of continuous duty, solid state type using proven Pulse Width Modulation (PWM)/Quasi square wave/step wave technique. Ferro-resonant types Inverters are not acceptable. The nominal voltage output shall be 230 Volts single phase ,50 Hz. The inverter equipment shall include all necessary circuitry and devices to conform to requirements like voltage regulation, current limiting, wave shaping, transient recovery, etc. The total harmonic content shall be 5% maximum and content of any single harmonic shall be 3% maximum.
- The static switch shall be provided to perform the function of transferring UPS loads automatically without any break from faulty inverter to standby AC source. Manual bypass switch shall be employed for isolating the UPS during maintenance.
- Contractor has the option of supplying either Nickel Cadmium type batteries or Lead Acid Plante type batteries. The detailed specification for the batteries has been mentioned in the battery and charger section below in this specification.
- Equipment enclosures shall match and line up in assemblies of freestanding floor mounted cabinets designed for indoor service.
- Individual enclosure shall be ventilated switchboard type fabricated from not less than 1.6-mm thick sheet steel. Enclosures shall be furnished with concealed hinges. Front and rear doors shall be designed to permit easy access to all components for maintenance or replacement. The enclosures shall be reinforced with formed steel members as required to form a rigid self-supporting structure. Doors shall have three point latches.
- Adequate ventilating louvers and enclosure top panels shall be included. All vent openings shall be covered with corrosion resistant fine screen coverings.
- The cabinets shall be IP-42 protection class for indoor application and IP65 for outdoor application.
- The temperature rise inside all the cabinets/enclosures shall not exceed 10 deg.C above ambient temperature.

- The Contractor shall also carry out the site tests on UPS as required to be conducted as a standard practice of the UPS manufacture or deemed necessary by the Employer and mutually agreed between the Contractor and the Employer.
- One set of tool shall be provided for maintenance and testing purposes.

### **12.3. BATTERY CHARGER**

- The chargers shall be self-regulating, solid state silicon controlled, full-wave rectifier type designed for single and parallel operation with battery and shall have automatic voltage regulators for close voltage stability even when AC supply voltage fluctuates, effective current limiting features and filters to minimise harmonics. The charger should be capable to fully charge the required batteries as well as supply the full rated load. Furthermore, the charger should be able to re-charge the fully discharged battery within 8 hours. The charger shall be current limited for charger circuit protection and protection of battery from overcharge shall also be provided. The current limit shall be continuously adjustable. The chargers shall have a slow walk-in circuit. Charger design shall ensure that there is no component failure due to fluctuations of input supply or loss of supply and restoration. The charger shall be design for input supply voltage variation of  $\pm 10\%$  and frequency variation of  $\pm 5\%$ .
- Battery Chargers shall have a selector switch for selecting the battery charging mode
  - i.e. whether Trickle or Boost charging.
- All Battery Chargers shall be provided with facility for both automatic and manual control of output voltage and current. A selector switch shall be provided for selecting the mode of output voltage/current control, whether automatic or manual. Means shall be provided to avoid current/voltage surges of harmful magnitude/nature which may arise during changeover from Auto to Manual mode or vice-versa under normal operating condition.
- Soft start feature shall be provided to build up the voltage to the set value slowly. The chargers shall have load limiters which shall cause, when the voltage control is in automatic mode, a gradual lowering of the output voltage when the DC load current exceeds the load limiter setting of the Charger. The load limiter characteristic shall be such that any sustained overload or short circuit in DC system shall neither damage the Charger nor shall it cause blowing of any of the charger fuses. The Charger shall not trip on overload or external short circuit. After clearance of fault, the Charger voltage shall build up automatically when working in automatic mode.
- When on automatic control mode during Trickle charging, the Charger output voltage shall remain within  $\pm 1\%$  of the set value for AC input voltage variation of  $\pm 10\%$ , frequency variation of  $\pm 3\%$ - $5\%$ , a combined voltage and frequency (absolute sum) variation of  $10\%$  and a continuous DC load variation from zero to full load. Uniform and step-less adjustments of voltage setting (in both manual

and automatic modes) shall be provided on the front of the Charger panel covering the entire Trickle charging output range specified & shall be capable of matching the float voltage correction recommendations (w.r.t. temperature) as suggested by the respective battery manufacturer. Step-less adjustment of the load limiter setting shall also be possible from 80% to 100% of the rated output current for Trickle charging mode.

- During Boost charging, the Battery Chargers shall operate on constant current mode (When automatic regulator is in service). It shall be possible to adjust the Boost charging current continuously over a range of 50 to 100% of the rated output current for Boost charging mode. The charger output voltage shall automatically go on rising, when it is operating on boost mode, as the battery charges up. For limiting the output voltage of the charger, a potentiometer shall be provided on the front of the panel, whereby it shall be possible to set the upper limit of this voltage anywhere in the output range specified for boost charging mode. All voltage and current setting potentiometers shall be vernier type.
- Energizing the Charger with fully charged battery connected plus 10% load shall not result in output voltage greater than 110% of the voltage setting. Time taken to stabilize, to within the specified limits as mentioned elsewhere, shall be less than fifteen seconds
- Momentary output voltage of the Charger, without the Battery connected shall be within 94% to 106% of the voltage setting during sudden load Change from 100% to 20% of full load or vice-versa. Output voltage shall return to, and remain, within the limits specified as mentioned elsewhere in less than 2 seconds after the above-mentioned change.
- Suitable filter circuits shall be provided in all the Chargers to limit the ripple content (peak to peak) in the output voltage to 1% irrespective of the DC load, even when they are not connected to a battery.
- The DC System shall be ungrounded and float with respect to the ground potential when healthy. An earth fault relay shall be provided by the bidder in the DC distribution board for remote annunciation.
- Digital Outputs shall be configured for connection to the SCADA for real-time charger status updation. Outputs like charger output current, output voltage, float/boost mode, etc may be configured to provide the update to SCADA.
- The Battery Chargers as well as their automatic regulators shall be of static type. The Chargers shall be designed to operate, as mentioned above, at an ambient air temperature of 50°C.
- **For Lead Acid plante battery:-**Battery chargers shall be capable of continuous operation at the respective rated load in Trickle mode i.e. Trickle charging the associated DC lead-acid Batteries while supplying the D.C. loads. The Batteries shall be Trickle charged at 2.25 Volts per cell. All chargers shall also be capable



of Boost charging the associated D.C. Battery at 2.3 to 2.7 Volts per cell at the desired rate.

- **For Nickel-Cadmium battery:** -Battery chargers shall be capable of continuous operation at the respective rated load in Trickle mode i.e., Trickle charging the associated DC Nickel-Cadmium Batteries while supplying the D.C. loads. The Batteries shall be Trickle charged at 1.4 to 1.42 Volts per cell. All chargers shall be capable of Boost Charging the associated D.C. Battery at 1.54 to 1.7 Volts per cell at the desired rate.
- All Battery Chargers shall have an AC contactor on the input side. It shall be of air break type and suitable for continuous duty. A thermal overload relay incorporating a distinct single phasing protection (using differential movement of bimetal strips) shall also be provided for the AC input. The relay shall trip the above contactor.
- The rectifier assembly shall be full wave bridge type and designed to meet the duty as required by the respective Charger.
- Digital or analog indicating instruments shall indicate DC current, DC voltage & AC voltage.
- The Chargers shall be indoor, floor mounted, self-supporting sheet metal enclosed cubicle type. The Contractor shall supply all necessary base frames, anchor bolts and hardware. The Charger shall be fabricated using cold rolled sheet steel shall not be less than 1.6 mm and shall have folded type of construction. The panel frame shall be fabricated using cold rolled sheet steel of thickness not less than 2.0 mm. Removable undrilled gland plates of at least 3.0 mm sheet steel and lugs for all cables shall be supplied by the Contractor. The Charger shall be tropicalised and vermin proof. Ventilation louvers shall be backed with fine brass wire mesh. All doors and covers shall be fitted with synthetic rubber gaskets. The Chargers shall have hinged double leaf doors provided on front and/or backside for adequate access to the Charger internals. All the Charger cubicle doors shall be properly earthed.
- Treatment as per IS: 6005. Two coats of lead oxide primer followed by powder painting with final shade of RAL9002 for complete panel except end covers & RAL 5012 for end covers.
- All acceptance and routine tests as per the manufacture recommendations and relevant standards shall be carried out.
- The cabinets shall be IP-42 protection class for indoor application and IP65 for outdoor application.
- The Contractor shall also carry out the site tests on battery charger systems required to be conducted as a standard practice of the UPS manufacture or deemed necessary by the Employer and mutually agreed between the Contractor and the Employer.

### 13. LIGHTNING PROTECTION SYSTEM

- The object of a lightning protection system is to protect buildings/structure and equipment from direct lightning strikes, potential fire as well as the effects of injected lightning currents (non-incentive flash). It consists of termination systems for direct lightning, down conductors and an earth-termination system.
- Care must be taken for while designing the lightning protection that surges are prevented in the electrical system to reduce failure of electrical and electronic equipments.
- This specification is intended to outline the requirement of external lightning protection (ELP/Lightning protection) for Solar array (DC) side and AC Power block side of Solar PV Project. It is not the intent of the specification to specify all details of design and construction since the bidder has full responsibility for engineering and implementation of external lightning protection system meeting the intent of the specification and functional requirement. Any additional equipment, material, services which are not specifically mentioned herein but are required for successful installation, testing and commissioning of earthing system for safe and satisfactory operation of the plant shall be included under scope of the bidder.
- Lightning protection requirement for outdoor metering yard/Switchyard has been mentioned elsewhere in the specification and hence shall be excluded from scope of this chapter unless Lightning protection requirement of metering yard/Switchyard is specifically mentioned in this chapter.

#### 13.1. CODES & STANDARDS

The equipment/product furnished for earthing system shall meet the requirements of all the applicable relevant National/International codes and standards or their latest amendment Codes and Standards. Product certification has to be CE/UL/BIS/TUV or equivalent. The relevant codes and standard for earthing system are tabulated below:

IS/ IEC 62305	PROTECTION AGAINST LIGHTNING
IEEE: 80	IEEE guide for safety in AC substation grounding
IEEE: 837	Standard for qualifying permanent connections used in substation grounding
IS: 2629	Recommended practice for hot dip galvanizing of iron & steel
IS: 2633	Method for testing uniformity of coating on zinc coated articles
IS: 513	Cold rolled low carbon steel sheets and strips
IS: 6745	Methods for determination of mass of zinc coating on zinc coated iron & steel



	articles.
IS 2062	HOT ROLLED MEDIUM AND HIGH TENSILE STRUCTURAL STEEL – SPECIFICATION
IS: 458	Precast Concrete Pipes (With and Without Reinforcement)
UL-467	Grounding and Bonding Equipment
IEC 62561-7	Requirements for earthing enhancing compounds
NFC 17 -102	Early streamer emission lightning protection Systems
	CEA regulations for electrical safety-2010
	Indian Electricity Rules/ Indian Electricity Act.

All standards, specifications and codes of practice referred to herein shall be the latest editions including all applicable official amendments and revisions as on date of opening of bid. In case of conflict between this specification and those (codes and standards, etc.) referred to herein, the former shall prevail. All work shall be carried out as per the above standards/ codes as applicable.

The lightning protection system includes lightning terminal, Down conductor, test link, earth electrode, installation of lightning terminal, down conductor and earth electrode in suitable pit size, construction of earth pit with cover for the installation, connection of earth electrode with lightning terminal.

### **13.2. DOWN CONDUCTORS**

Down conductors shall be as short and straight as practicable and shall follow a direct path to earth electrode.

Each down conductor shall be provided with a test link at 1000 mm above ground level for testing but it shall be in accessible to interference. No connections other than the one direct to an earth electrode shall be made below a test point. All joints in the down conductors shall be welded type.

Down conductors shall be cleated on outer side of building wall, at 750 mm interval or welded to outside building columns at 1000 mm interval.

Lightning conductor on roof shall not be directly cleated on surface of roof. Supporting blocks of PCC/insulating compound shall be used for conductor fixing at an interval of 1500 mm.

All metallic structures within a vicinity of two meters of the conductors shall be bonded to conductors of lightning protection system.

Lightning conductors shall not pass through or run inside GI Conduits. Testing link shall be made of galvanized steel of size 25x 6mm.

### **13.3. LIGHTNING PROTECTION SYSTEM FOR SOLAR ARRAY**

#### **13.3.1. Codes and Standard**





IS/IEC 62305 : PROTECTION AGAINST LIGHTNING

NF C 17-102 : LIGHTNING PROTECTION WITH EARLY

STREAMER AIR TERMINATION ROD

Complete Solar Array with associated structure shall be protected from Direct Lightning Stroke. Lightning Protection for solar array shall be achieved with any or both of the following two systems as per specification provided in the following section.

- Single Rod Air Terminal (Faraday Rods)
- Early Streamer Emission (ESE) Air Terminal
- Suitable earthing and equipotential bonding shall be ensured for the lightning protection Air Terminal as per applicable standard/Equipment manufacturer guidelines.
- Current carrying parts and accessories such as clamps, fasteners, down conductor, Test links and earth termination etc. shall be preferably procured from OEM of Air Terminals if it is supplied by them as part of lightning protection system.

#### **13.4. LIGHTNING PROTECTION SYSTEM FOR SOLAR ARRAY WITH SINGLE ROD AIR TERMINAL**

Solar array of plant shall be protected from direct lightning strike with straight or angled air termination rods of suitable class as per IS/IEC 62305 to be fixed with the module mounting structure (MMS). Air termination rods shall have minimum two clamps to be fixed with MMS and must be capable of carrying full lightning current.

Contractor shall ensure proper fixing of the clamps with MMS to allow lightning current to pass through the clamp without damage and to sustain the rods during high velocity wind.

Contractor shall submit the calculation to determine the no. and location of air termination rods to be fixed on structure to provide the lightning protection to each solar module and structure.

Earth riser shall be connected to that part/pole of MMS which is nearest to air termination rod.

#### **13.5. LIGHTNING PROTECTION SYSTEM FOR SOLAR ARRAY WITH E.S.E AIR TERMINAL**

Solar array shall be protected from direct lightning stroke with Early Streamer Emission air terminal in accordance to NF C 17-102.

Location and layout of ESE terminal shall be in such a manner that it cast no shadow on the PV Modules during 08:30 AM to 04:30 PM. Number and location of ESE air terminal shall be decided during detail engineering. For this purpose, design calculation



considering protection level III (minimum) and Autocad drawing of the layout of ESE terminal shall be submitted to MAHAPREIT for approval.

ESE air terminal shall be type tested as per Annexure- C of NF C 17-102 (Latest Revision) in the manner as mentioned in the standard.

ESE Air terminal shall be supplied with test link, counter, down-conductor, Tripod Earthing, support mast and accessories required for completeness for ESE Lightning protection system.

Owner shall test ESE terminal (Each terminal/Sample basis) before installation with suitable instrument for functionality of terminal. Vendor shall replace the terminal free of cost if found defective.

Support mast for ESE Air terminal shall be heavy duty hot dip galvanized material and shall be suitable to withstand dynamic and static forces acting on it without failure. Foundation for the mast shall be M20 Grade concrete or better with minimum depth of 1200 MM.

### **13.6. LIGHTNING PROTECTION SYSTEM FOR BUILDING AND ENCLOSURE**

Contractor shall provide lightning protection for Inverter room/shelter/enclosure, main control room, Switchgear Room/shelter and similar housing per IS/IEC 62305.

Lightning protection for Metering yard/Switchyard shall be provided as per requirement mentioned in respective chapter. ESE air terminal shall not be used for Metering yard/Switchyard.

### **14. METERING SYSTEM**

1. Energy meter (0.2s accuracy class suitable for ABT-TOD requirement with metering panel as required conforming to STU/PGCIL requirement shall be as per Chapter-A2.
2. For measurement of Auxiliary power consumption, MFM in ACDB incomer shall be provided by the bidder.
3. Meter shall be suitable for interfacing for synchronizing the built-in clock of the meter by GPS time synchronization equipment. Bidder shall synchronize the meter using GPS time synchronization equipment. All the hardware required for synchronization shall be in scope of bidder.
4. The ABT meters supplied under this contract shall also meet the requirement of respective RLDC/State power Utilities.
5. This metering system shall have following features:
  - i. Meters shall be microprocessor-based MWH meters having an accuracy class of 0.2S or better. MVARH meters shall have accuracy class of 0.5 or better.
  - ii. These meters shall have provision for downloading of data through an optical port and /or through RS 232/485 port.



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

6. Technical Requirements of Energy Meters for ABT Requirement

Contractor shall supply energy meters along with metering station, 4 Nos. machine Clients, 20 nos web client license. MRI or lap top (as applicable) as per the technical specification given below:

- a. Shall be microprocessor-based conforming to IEC 62052-11, IEC 62053-22, IS 14697
- b. Shall carry out measurement of active energy (both import and export) and reactive energy (both import and export) by 3-phase, 4 wire principle suitable for balanced/ unbalanced 3 phase load.
- c. Shall have an accuracy of energy measurement of at least Class 0.2S for active energy and at least Class 0.5 for reactive energy.
- d. The active and reactive energy shall be directly computed in CT & VT primary ratings.
- e. The reactive energy shall be recorded for each metering interval in four different registers as MVARh (lag) when active export, MVARh (Lag) when active import, MVARh (lead) when active export, MVARh (Lead) when active import.
- f. Two separate registers shall be provided to record MVARh when system voltage is >103% and when system voltage is < 97%.
- g. Shall compute the net MWh and MVARh during each successive 15-minute block metering interval along with a plus/minus sign, instantaneous MWh, instantaneous MVARh, average frequency of each 15 minutes, net active energy at midnight, net reactive energy for voltage low and high conditions at each midnight.
- h. Each energy meter shall have a display unit. It shall display the net MWh and MVARh with a plus/minus sign and average frequency during the previous metering interval; peak MWh demand since the last demand reset; accumulated total (instantaneous) MWh and MVARh with a plus/minus sign, date and time; and instantaneous current and voltage on each phase.
- i. All the registers shall be stored in a non-volatile memory. Meter registers for each metering interval, as well as accumulated totals, shall be downloadable. All the net active/reactive energy values displayed or stored shall be with a plus /minus sign for export/import.
- j. At least the following data shall be stored before being over-written for the following parameters.

	<b>Parameters</b>	<b>Details</b>	<b>Min No of days</b>
1.	Net MWH	15 min block	40days in meter



2.	Aver Freq	15 min block	40days in meter
3.	Net MVARH for V > 103%	15min block	40days in meter
4.	Net MVARH for V < 97%	15min block	40days in meter
5.	Cumulative Net MWH at every midnight		10 days in meter/ 40 days in PC
6.	Cumulative Net MVARH for V>103% at every midnight		10 days in Meter/ 40 days in PC
7.	Cumulative Net MVARH for V <97% At every midnight		10 days in Meter/ 40 days in PC
8.	Date and time blocks of VT failure on any phase.		

- k. Shall have a built-in clock and calendar with an accuracy of less than 15 seconds per month drift without assistance of external time synchronizing pulse.
- l. Date/time shall be displayed on demand. The clock shall be synchronized by GPS time synchronization equipment being supplied by the contractor.
- m. The voltage monitoring of shall be inbuilt feature provided to signal failures to the Substation Automation System, The meter shall be suitable to operate with power drawn from the VT supplies. The burden of the meters shall be less than 2 VA.
- n. The power supply to the meter shall be healthy even with a single-phase VT supply. An automatic backup, in the event of non-availability of voltage in all the phases, shall be provided by a built-in long-life battery and shall not need replacement for at least 10 years with a continuous VT interruption of at least 2 years. Even under absence of VT input, energy meter display shall be available and it shall be possible to download data from the energy meter. In case data downloading is not possible in absence of VT supply, meter with provision of 220V DC auxiliary power shall be provided. Date and time of VT interruption and restoration shall be automatically stored in a non-volatile memory.
- o. Shall have an optical port on the front of the meter for data collection from either a hand-held meter reading instrument (MRI) having a display for energy readings or from a notebook computer with suitable software. The contractor shall supply the MRI and/or notebook complete with all optical interface unit required.
- p. The meter shall have means to test MWh and MVARh accuracy and calibration at site in-situ and test terminal blocks shall be provided for the same.
- q. Each meter shall have a unique identification code provided by the Owner

and shall be permanently marked on the front of the meter and stored in the non- volatile memory of the meter.

#### **14.1. Type Test requirement for Energy Meter**

All Type Test Reports shall be provided as per IEC 62052-11, IEC 62053-22, IS 14697.

### **15.132 kV SWITCHYARD & 33 kV OVERHEAD LINE**

#### **15.1. SCOPE AND GENERAL INFORMATION**

This specification intends to cover the following activities, services and work in respect of 132 kV switchyard & 33kV O/H lines at Sangli Solar Power Project situated in the Sangli district of Maharashtra, India:

- a. Complete design and engineering of all the systems, sub-systems, equipment, material and services.
- b. Providing engineering data, drawings and O&M manuals for Employer's review, approval and records.
- c. Manufacturing, supply, testing, packing, transportation and insurance from the manufacturer's work to the site including port and customs clearance, if required.
- d. Receipt, storage, insurance, preservation and conservation of equipment at the site.
- e. All civil works as required.
- f. Fabrication, pre-assembly (if any), erection, testing and putting into satisfactory operation of all the equipment/material including successful commissioning.
- g. Furnishing of spares on FOR site basis.
- h. Reconciliation with customs authorities, in case of foreign supplies.
- i. Satisfactory completion of the system

In addition to the requirements indicated in this section (Technical specifications), all the requirements as stated in other sections shall also be considered as a part of this specification as if completely bound herewith.

The Bidder shall be responsible for providing all material, equipment and services specified or otherwise which are required to fulfil the intent of ensuring operability, maintainability and the reliability of the complete work covered under this specification. The systems, sub-systems and equipment shall conform in all respect to high standards of engineering, design and workmanship, and shall be capable of performing in continuous commercial operation.

The scope of work comprises of 132kV Switchyard & execution of 33 kV O/H lines at Sangli Solar Power Project. The 132 kV Switchyard shall be with Single Bus Switching Scheme as indicated in Tender SLD. 33 kV Overhead lines on RSJ poles shall be with ACSR Dog/Rabbit conductor. The scope of work shall comprise, but not limited to the design, engineering, manufacture, testing and inspection at manufacturer's works, packing, supply, transportation, transit insurance, delivery to site, unloading, storage and equipment erection, associated civil and structural works. Further, it shall include



cabling, lighting, lightning protection, earthing, association of sub vendors if any in the erection, supervision, site testing, inspection and commissioning of 132 kV Switchyard & 33 kV Overhead lines.

- a. 132 kV Bay details:
  - i. Two nos. of 70 MVA, 33/132 kV Tie-Transformer bay
  - ii. Two nos. of Line bays
  - iii. One no. of Bus section bay
- b. 33 kV Overhead lines on Galvanised RSJ Poles with ACSR Dog/Rabbit conductor

This scope covers all the work required for detailed soil investigation. It shall include mobilization of necessary equipment, providing necessary engineering supervision and technical personnel, carrying out field investigation and tests, laboratory tests, analysis and interpretation of data and results, collecting data regarding geographical conditions from local sources, giving flood details of the area (past history), preparations for the type of foundations and the safe bearing capacity for different sizes of foundations, different founding strata for the various locations along the transmission lines.

The equipment and materials to be supplied by the Contractor shall form a complete 132 kV switchyard & 33 kV O/H line. The equipment and services as detailed in all sections of the bidding documents and as shown on the tender drawings shall be within the scope of supply of the Contractor.

#### **15.2. SERVICES AND ITEMS**

The scope also include but not limited to the following services/items described herein and elsewhere in specification:

- a) System design and engineering
- b) Supply of equipment and material
- c) Civil works
- d) Structural works
- e) Erection works
- f) Project management and site supervision
- g) Testing and commissioning
- h) Interface coordination
- i) Performance testing
- j) Clearance from statutory authority. Owner shall provide support for this activity.

The Contractor shall be responsible for detailed design and engineering of overall system, sub-systems, elements, system facilities, equipments, auxiliary services,



etc. It shall include proper definition and execution of all interfaces with systems, equipment, material and services of Employer for proper and correct design, performance and operation of the project.

Contractor shall provide complete engineering data, drawings, reports, manuals, etc. for Employer's review, approval and records. The scope shall also include the design and engineering as per details elaborated elsewhere in this specification.

- a) For all structural works, the Contractor shall prepare design and fabrication drawings. Similarly, for civil works, the detailed construction drawings shall be prepared for those items whose design is to be done by the Contractor.
- b) The Contractor shall be responsible for design, engineering, manufacture, testing, inspection at manufacturer's works, supply, transportation, insurance, delivery at site, unloading, storage, in plant transportation at site, complete erection & supervision, site testing & inspection, and successful commissioning of all the equipment and material as detailed elsewhere in specification and as shown on the tender drawings. Any item though not specifically mentioned, but is required to complete the project works in all respects for its safe, reliable, efficient and trouble-free operation shall be supplied and erected by the Contractor unless it is explicitly excluded as given elsewhere in the chapter.
- c) All consumables, wastages and damages shall be to the account of Contractor
- d) The scope of civil works shall include design, engineering & construction of all civil, structural and architectural works including supply of all materials complete for all equipments, gantry structures (as applicable) and associated facilities for the Switchyard & O/H lines.
- e) The nature of work generally involves earthwork in excavation and filling in all types of soils/ rock, dressing to the required profile, dewatering till the structures are constructed/erected up to required level or as directed by the engineer, shoring, backfilling around completed structures and plinth filling, disposal of surplus earth, concreting including reinforcement and formwork, fabrication and erection of all structural steel and miscellaneous steel (i.e. cable/pipe supports, ladders, railings, inserts, embedments, gratings, chequered plate covers, platforms, anchor bolts, etc.), rail track for movement of transformers, fabrication, galvanising, Proto-assembly & erection of Gantry Structure, Lighting Mast & Equipment supporting structure,
- f) R.C.C. cable trench & precast covers, cable ducts / duct banks, soil sterilisation / anti-weed treatment, gravel filling, drainage, fencing, gates, final grading, supplying and laying earthing mat and any other work required for completion and proper functioning of the switchyard.
- g) All material including cement, reinforcement steel and structural steel required



for completion of the work covered under this package are in the scope of the bidder.

All works relating to design, preparation of drawings including fabrication drawings, procurement of material, fabrication, proto assembly, mass fabrication, transportation to site, handling, storage and erection of all Towers & Beams, Lightning Mast and Equipment supporting structures (both lattice type and pipe type) for the Tie-transformer Switchyard bay area as per design and drawings to be prepared by the Contractor and approved by the Owner. This shall also include all types of bolts, nuts, hangers, shackles, clamps, step bolts etc. and any other items those are required to complete the job.

The Contractor shall construct, erect and install all structures, equipments and material of Tie-transformer Switchyard bay area. He shall be responsible for provision of all labour, tools and plant, and supervisory staff for safe, reliable, proper and correct erection of project components.

The tools and plant shall include, but not limited to, special hoisting equipment, cranes, stringing equipment, slings, consumables and all other articles and supplies as required.

The Contractor shall ensure periodic cleaning of work sites and removal of all waste material, packing material, surplus earth and left-overs and their proper disposal.

#### **15.2.1. Testing and Commissioning**

- a) The scope includes testing and commissioning of all equipment, sub- systems and systems of the project and putting them into successful commercial operation. The scope shall include but not limited to the requirements given elsewhere in the specification.
- b) The Contractor shall be responsible to provide all necessary testing and commissioning personnel, tools and plant, test equipment, etc.
- c) Interface Coordination
- d) The Contractor shall identify all interface issues with Employer and other agencies, and shall be responsible for such interfacing, coordination and exchange of all necessary information.
- e) The Contractor shall submit to the Employer all drawings for review. He shall list the detailed requirements of interface between Contractor's work and the material and services to be supplied by Employer.

#### **15.3. SPARES**

All spares supplied under this contract shall be strictly interchangeable with the parts for which they are intended for replacement. The spares shall be treated and packed for long term storage in the climatic conditions prevailing at the site. Small items shall be packed in sealed transparent plastic covers with desiccant bags as necessary.





Each spare part shall be clearly marked and labeled on the outside of the packing together with the description when more than one spare part is packed in single case. A general description of the contents shall be shown on outside of the case and detailed list enclosed. All cases, containers and other packages must be suitably marked and numbered for the purpose of identification.

Commissioning spares: The Bidder shall include in his scope of supply all commissioning spares. List of such spares along with the quantities shall be indicated in the bid.

The Contractor shall supply spares which he expects to consume during installation testing and commissioning of system. The quantity of these spares shall be decided based on his previous experience, such that site works shall not be hampered due to non-availability of these spares.

Contractor shall submit a complete list of such spares along with the bid, the cost of which shall be deemed to have been included in the lump sum proposal price of the package. The unused commissioning spares may be left at the site for use by the Owner, if so agreed at a cost to be negotiated. No mandatory or recommended spares will be used during the commissioning of the equipment/plant before take over by the Employer.

#### 16. Factory Acceptance Tests (FAT)

1. All equipment furnished under this specification shall be subject to test by authorized quality assurance personnel of the contractor and Owner's representatives during manufacture, erection and on completion. The approval of the Owner or passing such inspections or tests will not, however, prejudice the right of the Owner to reject the equipment if it does not comply with the specifications when erected or fails to give complete satisfaction in service. The detailed requirement of operational and pre-FAT tests as well as FAT test (Integrated Test) is given in this Section.
2. The FAT shall be mutually agreed upon and approved by Owner during detailed engineering.
3. Operational and Pre-FAT Tests
  - i. The authorized quality assurance personnel of the contractor shall conduct all tests as per the requirements and fully satisfy themselves regarding completeness of hardware, software and full compliance with specification requirements by all equipment/sub-systems and the system as a whole before sending notification for FAT to the Owner. Contractor shall maintain accurate records for all pre-FAT tests which shall be properly documented and duly certified documents shall be furnished to Owner at least two weeks prior to FAT tests, while giving inspection call.
  - ii. Each individual item of equipment/ sub-system/ software package furnished by the Contractor as well as the complete system as per this specification shall be



inspected and tested by the Contractor in his works for full compliance with specification requirements, completeness, proper assembly, proper operation, cleanliness and state of physical condition as applicable.

- iii. The Contractor shall conduct a point by point wiring continuity check to every input and output and verify that the wiring connections agree with the documentation.
  - iv. Contractor shall conduct all tests as per requirements (Factory Acceptance Tests) to fully satisfy himself regarding completeness of the system and full compliance with specification requirements for SAS as a whole as well as for individual components/ software module. This test will be done for 100% samples, even if the FAT requires tests for only some smaller percentages.
  - v. The pre-FAT report shall be in the format of FAT procedure as approved by the Owner. It shall be accompanied by a very detailed report, in a log form, of the performance of all pre-FAT Tests. These records shall list not only the successfully completed tests, but shall detail all system, test and component failures.
4. Notification for FAT
- i. Contractor shall send notification regarding readiness for FAT and indicate the proposed date for commencement of FAT to enable the Owner to depute representatives for participating in these tests. The notification shall be sent to the Owner not less than one week prior to commencement of the FAT along with the copies of documents covering pre-FAT results.
  - ii. The Contractor shall ensure that all hardware and software required for fully implementing the system as per requirements of this specification is available and the adequacy of hardware, software, system configuration, etc., is fully established during the pre-FAT Tests conducted by the Contractor. In case any deficiencies in hardware and/or software are noticed by the Contractor during the pre-FAT Tests, the Contractor shall make good all such deficiencies and re-conduct the required tests to fully satisfy him regarding completeness of the system and full compliance with specification requirements before sending notification to the Owner regarding FAT Tests.
5. Factory Acceptance Tests (FAT)
- i. Factory Acceptance Tests (FAT) shall include all tests required to fully demonstrate to Owner's satisfaction that each equipment/sub- system/system as well as software modules furnished as per this specification as well as SAS as a whole, fully meets the functional, parametric and other requirements of this specification and Owner's approved drawings/documents under all operating regimes. The testing shall be conducted with the all the SAS components fully interconnected as per the final system configuration, including BCU, BPU and other protection relays. The Owner shall witness all FAT tests.
  - ii. The Factory Acceptance Tests (FAT) shall include all reasonable exercises which the combination of equipment and software can be expected to perform.



- iii. The Contractor shall submit a detailed FAT procedure for Owner's approval during detailed engineering stage based on the above guidelines. The FAT procedure to be submitted by the Contractor shall be detailed and exhaustive enough such that Owner is satisfied that all the SAS System specification requirements and features are being tested and the system meets these requirements. The test results obtained shall be properly documented by the Contractor and furnished in the Owner approved format as decided during detailed engineering and submitted in the requisite number of copies with all annexes irrespective of the fact that Owner's representative was present during the tests.

#### 17. Site / Commissioning Tests

- A. Site tests shall include all tests to be carried out at site upon receipt of equipment. It shall include but not be limited to testing calibration, configurations and pre-commissioning trials start up tests, trial operation and performance and guarantee tests. The Contractor shall be responsible for all site / commissioning tests.
- B. The Contractor shall maintain all tests, calibration records in Owner approved formats, and these shall be countersigned by authorized quality assurance personnel of the Contractor supervising these works.
- C. The Contractor shall maintain master checklists to ensure that all tests and calibration for all equipment/devices furnished under these specifications are satisfactorily completed under the supervision of the authorized quality assurance personnel of the Contractor.
- D. The site / commissioning tests shall be categorized under following categories:
  - i. Start up tests
  - ii. Calibration and configuration checks
  - iii. Pre-commissioning tests
  - iv. Trial Operation
  - v. Availability Tests
- E. Point-to-point testing of all the I/O signals in the 132kV network shall be done by the Contractor.
- F. Point-to-point testing shall include:
  - i. Verification of all status indications by operating the plant
  - ii. Verification of event / alarm indications by simulating alarm conditions
  - iii. Verification of all analogue indications by injection testing
  - iv. Verification of all controls by operating the plant
- G. Availability Tests
  - i. The Contractor shall guarantee 99.9 percent availability for a continuous period of 180 days. Availability guarantee test shall be conducted to assure this level of availability. If the accrued down time exceeds 0.1% of 180 days, during availability test run, a new 180 days test run shall start at the time when the system becomes available again. Loss of availability



(unavailable system) shall be defined as the loss of the systems guaranteed accuracy and repeatability or of any system function, except however, that the loss of a function for not more than five percent of the points shall not be considered loss of availability. Loss of function for not more than 5% of the points shall be treated as partial unavailability and the corresponding outage time shall be weighted with respect to the function and the percentage of the points for which the function is unavailable. Loss of each function shall have one weighing factor and unavailability of each equipment, peripherals device or process I/O card etc. shall have another weighing factor. The guaranteed accuracy and repeatability and system parametric requirements specified in clauses on system parametric requirements shall be maintained for the entire 180 days run without any manual re-calibration or any other changes made to the SAS.

- ii. Downtime shall start upon loss of a system function and shall end upon full restoration of the affected system function. A minimum of one hour's down time shall be charged for each loss of availability in determining system availability.
- iii. The Contractor shall submit the Availability Test Procedure for Owner's approval. The details regarding outage time, weighing factors for various systems functions equipment to calculate the down time shall be discussed and finalized during detailed engineering.
- iv. The availability test shall start at a date, which will occur, between the commissioning date and 5 months after commissioning.
- v. The availability test shall be expressed as percentage, which shall be calculated as  $(100\% \times (\text{test duration time} - \text{Accumulated test outage time}) / \text{Test duration time})$ .
- vi. System outage time will be accumulated over test duration and calculated as outage time x weighing factor. The contractor shall submit a list of weighing factors for all system components along with the bid and the same will be mutually finalized before contract award. Outage time shall be weighted by each function's weighing factor.

#### 18. System Hand-over and Final Acceptance

- i. The system will be handed-over to the Owner for commercial operation after the site / commissioning tests have been completed to the satisfaction of the Owner. A hand-over certificate will be issued by the Owner. The Contractor will still be responsible for the Availability Tests.
- ii. Final acceptance of the system by the Owner will take place after the Availability Tests have been done to the satisfaction of the Owner.

#### 19. CIVIL WORKS

##### 19.1. SITE LEVELING AND GRINDING

Site levelling works involves the following works:

1. All works related to site clearances including removal of bushes, trees, removal of roots, shrubs and other vegetations, levelling, grading, finishing and other additional works shall be carried out by the Contractor. Mandatory permission/licenses/ statutory clearances from Competent Authorities for site levelling activities like removal of trees and bushes, undertaking blasting related works, disposal of cutting material etc. shall be carried out by the contractor.
2. Site grading level shall be fixed with due reference to site drainage of the whole area, existing drainage pattern, maximum flood level and system requirements.
3. Site levelling works/scheme shall match with the specific functional requirement of Solar PV optimum generation considering the full utilization of the plot area for the desired capacity.
4. Consideration from the boundary and fencing requirements.

Based on the spot level, contour survey done and meeting above requirements, bidder can propose different site grade levels. The site levelling may be carried in patches/blocks. Bidder may also propose the site leveling and grading matching with the natural topography of the land considering the optimized use of the land, however bidder shall ensure to meet the desired power generation capacity in the allotted plot area. Bidder shall also ensure that no water ponding and flooding occurs in the low-lying areas & effective drainage is provided in the whole plot area, in all kind of site levelling and grading or plant at natural topography schemes, bidders has to ensure to provide proper and effective drainage system in line "DRAINAGE SYSTEM" chapter. After performing the optimization of levels from the detailed site survey by the Contractor, the final formation level of the plot in various areas shall be finalized. The area shall be suitably cut and filled to suit the layout requirement. The site levelling and grading scheme incorporating the above aspects shall be submitted to MAHAPREIT for approval.

Fill shall normally be made up of Cohesive Non swelling material capable of being compacted upto 95% Modified Proctor density. In case earth has to be borrowed from outside the plant boundary, the same shall be arranged by the Contractor himself. The slope at the edge of graded areas shall not be flatter than 1:1.5 (1 vertical to 1.5 horizontal) in cutting and 1:2 in filling. In case of fill by rock material, the same shall be done in line with relevant Indian Standard.

All buildings & switchyard area/sub-station area shall be constructed in levelled area. No foundation shall be allowed on back filled soil and in that case the depth of foundations shall reach up to NGL. Final Level will be approved in detail engineering.

The slope protection measure shall be provided in case inter levelled patches level difference is more than 2.0m. Random rubble/boulder/stone pitching/concrete blocks



etc. shall be provided for the slope protection for road side slope, storm water ditches/drainage, embankment slopes, inter levelled patches slopes etc. as per design requirements

## **19.2. BOUNDARY WALL, FENCING AND GATE**

The scope of work includes providing either or combination of following as per scope defined in Vicinity Map of the proposed Solar plant for the peripheral and common boundary.

1. Pre-Stressed Precast Boundary Wall.
2. Chain Link Fencing for Boundary.
3. Barbed wire fencing

### **19.2.1. RE STRESSED PRECAST BOUNDARY WALL**

Precast boundary wall shall be provided on the periphery of the complete solar plant. Pre stressed precast boundary wall shall be executed in line with the relevant tender drawings as mentioned in the technical specification. Bidder has to do the boundary work for its allotted plot/plots, he completes periphery boundary works & gates of the plots shall be constructed by the bidder.

Bidder scope of work includes casting of pre-stressed precast boundary all panels, columns etc. at bidder's facility/facility established by bidder at site/manufacturing unit, transportation of precast units at site and storage locations identified by MAHAPREIT, excavation for casting of foundation and fixing of panels as per drawing, construction of foundation, erection of columns to plumb & wall panels with required T&Ps, fixing of concertina with all items, backfilling as per specification etc. complete in all respect.

The bidder shall also submit construction drawing for MAHAPREIT approval before manufacturing and execution at site. The construction drawing shall also incorporate suitable scheme to place precast boundary wherever there are changes in ground levels, corner, joint, water body crossings etc.

1. The total height of boundary wall shall be minimum 2850mm above formation level (Finished ground level in case formation level is less than natural ground level). Upto height of 2000mm, it shall be constructed with pre-stressed precast reinforced cement concrete panels fixed to grooves made in pre-stressed precast reinforced cement concrete column and over that for 600mm concertina coil with maximum loop spacing of 125mm shall be provided with Y-shaped MS angle.
2. The pre-stressed precast reinforced cement concrete columns shall be provided at spacing not more than 2200mm c/c.
3. The pre-stressed precast reinforced cement concrete columns foundation shall be minimum 1000mm below finished formation level. The boundary wall panels shall be at least 100mm below formation level. The boundary wall columns of minimum size 200mmX150mm shall be provided with two grooves of minimum size

55mmX50mm, so as to receive boundary wall panels spanning from column to column with minimum width of 300mm and minimum thickness of 50mm as filler wall

4. The grade of concrete for all pre-stressed precast panels and column, etc. shall be of minimum M30 grade and Grade of foundation block shall be min M25 grade conforming to IS 456. The size of the foundation shall be decided based on the site conditions however the minimum diameter of the foundation shall not be less than 350mm and depth less than 1000mm.
5. The boundary wall column with suitable provision for MS angle Post for concertina throughout the boundary wall shall be provided as per shown in drawing.
6. Opening for gates/drains and for other crossing has to be suitably provided as per the requirement/drawing/instructions of engineer in charge.
7. Bidder has to ensure that damages such as cracks and chipping off of corners do not happen during handling due to knocking etc. In case, such damages happen, the same has to be brought to the notice of engineer in charge.
8. In case the damage is minor, the same has to be made good using approved epoxy resin. Non shrink grout can be used for chipped off corners. No monetary claim shall however be admissible for such repairs. The engineer in charge reserves the right to accept or reject any damaged precast unit and the decision shall be binding on the bidder

The bidder is to carry out the work of Pre-stressed precast boundary wall as per the requirement of Technical specification and drawings issued to him and/or Contractor's drawings which are approved by the Engineer and/or the Engineer's instructions.

Suitable foundation and boundary wall arrangement with steel grating/grill shall be made in the boundary wall scheme to ensure intact wall/safety in the water body/drains entry and exit points in the plot area. The boundary wall shall be at sufficient height from water level. The toe wall for fencing at water body area shall be made of RCC only.

## **19.2.2.CHAIN LINK FENCING**

### **19.2.2.1. Boundary Wall**

The chain link fencing shall comprise of G.I chain link fencing with mesh size 75x75 mm and of minimum 3.15 mm diameter and diameter of bare galvanised wire shall not be less than 4.0 mm as per IS 278. The chain link fencing material requirement shall confirm to IS: 2721.

1. The G.I. chain link wire mesh will be stretched and attached by clips to 3 strands of High Tensile Spring Steel (HTSS) wire of 2.5 mm dia interwoven in chain link wire mesh and kept under tension which in turn are attached to the fence post with security nuts and bolts. On every fourth post a clamping strip will be threaded through the links of chain link and bolted to the fence post with the help of security

- nuts and bolts. All nuts, fasteners, bolts, clamping strips, clamps, clips, etc. shall be galvanized.
2. Above the chain link fence three rows of galvanized barbed wire (Type-A Grade designation -3 as per IS 278), twisted around minimum 2.5mm galvanized bare wire shall be provided in the Half Y steel post at a maximum spacing of 175 mm c/c. Reinforced barbed wire will be attached to angle iron posts vertical height 400 mm. The type of section for fence shall be as mentioned in the fencing drawing and details of scope of work of fencing in plot layouts.
  3. All fence posts shall be 75X75X5 MS angles spaced at 2.5 m c/c distance. All corner fence posts will have two stay posts in orthogonal directions and every tenth post will have a stay post in the direction of the fence. All stay posts shall be 75X75X5 MS angles. Concrete foundations for the angle iron posts and stays shall be provided as per the drawing. Toe wall shall be provided between the fence posts all along the run of the fence with foundation as per the tender drawing.
  4. All MS angles and members used in posts shall also be galvanized in line with relevant codal provisions.
  5. Suitable foundation/fencing arrangement shall be made in the fencing scheme to ensure intact fencing/safety in the water body/drains entry and exit points in the plot area. The same may be provided with a grid of MS angles of 75X75X5 sizes with foundation.

### **19.2.3.Main Gate**

1. Mild Steel frame gate woven with chain linking having minimum span 4 m conform to IS: 2062 shall be provided. The gate shall be complete with guide track, castor wheel, all fitting and fixture like hinges, aldrops, locking arrangement, posts etc The width of approach road shall cover the gate width at the main entrance with suitable transition. All members used in gates shall be finished by cleaning of steel surfaces as per IS: 1477 (Part-II) and applying zinc chrome or zinc phosphate primer, followed by two coats of synthetic enamel paint. For finishing coat suitable colour pigment shall be added. All paints including primer shall be of reputed brand / manufacturer and as approved by the Engineer-In-charge. The method of application shall be as per the recommendations of the manufacturer.
2. One man movement passage gate (minimum 1.2m width) shall also be provided at main entry gate. 400 mm height concertina with all supporting members shall also be provided on gate (gates other than main entry gate) for better security.

**\*\*\*\*\*END OF SECTION\*\*\*\*\***