

The undersigned has full power to execute this Indemnity Bond for and on behalf of the Contractor and the same stands valid.

SIGNED BY :

For [*Contractor*]

Authorised Representative

Place:

Dated:

Witnesses:

- 1.
- 2.

F-16

FREQUENTLY ASKED QUESTIONS (FAQs)

SL.NO.	QUESTION	ANSWER
1.0	Can any vendor quote for subject Tender?	Yes. A Vendor has to meet Bid Evaluation Criteria given under Section II of Tender document in addition to other requirements.
2.0	Should the Bid Evaluation Criteria documents be attested?	Yes. Please refer Section II of Tender document
3.0	Is attending Pre Bid Meeting mandatory.	No. Refer Clause No. 17 of Instruction to Bidders of Tender Document. However attending Pre Bid Meeting is recommended to sort out any issue before submission of bid by a Bidder.
4.0	Can a vendor submit more than 1 offer?	No. Please refer Clause No. 4 of Instruction to Bidders of Tender Document.
5.0	Is there any Help document available for e-Tender.	Refer FAQs as available on GAIL E-Tender portal.
6.0	Are there are any MSE (Micro & Small Enterprises) benefits available?	Yes. Refer Clause No. 40 of Instructions to Bidders of Tender Document.
7.0	Are there are any benefits available to Startups?	Refer Clause No. 50 of Instructions to Bidders of Tender Document.

All the terms and conditions of Tender remain unaltered.

SECTION-IV
GENERAL CONDITIONS OF
CONTRACT [GCC]

**[General Conditions of Contract-Works is
available on GAIL's Tender website
(<http://gailtenders.in/Gailtenders/gccs.asp>)]**

SECTION-V
SPECIAL CONDITIONS OF
CONTRACT [SCC]

SPECIAL CONDITIONS OF CONTRACT [SCC]

SPECIAL CONDITIONS OF CONTRACT (SCC)

1. CONDITIONS:

The Special Conditions of Contract shall be read in conjunction with the General Conditions of Contract, Schedule of Rates, Scope of work & Technical Specification, Bidder's Checklist and any other document forming part of contract whether context so requires.

Notwithstanding the sub-division of the documents in to separate sections, every part of each shall be deemed to be supplementary of every other part and shall be read with and into the contract so far as it may be practicable to do so.

Where any portion of the Special Conditions of the Contract (SCC) is repugnant to or at variance with any provision of the General Conditions of the Contract then unless a different intention be deemed to override the provisions of the General Conditions of Contract (GCC) only to the extent such repugnance or variation if the SCC as are not possible of being reconciled with the provisions of the GCC.

In case of any contradiction the decision of Engineer in-charge will be final and binding to the contractor.

2. SITE INFORMATION:

The work site will be GAIL-Terminals of NFL Vijaipur, Chittorgarh and NTPC-Anta.

It is understood that before quoting the rates, the contractor has visited the work site and has acquainted himself fully with the nature and quantum of work to be done. Ignorance of this, after award of contract will not be considered.

It is understood that the scope of work shall include, alias, the carrying out of any and / all works and providing any/ all facilities as required for completing the works as per the terms and conditions of contract documents.

The contractor shall be responsible to complete the entire work in all respects and any of the work necessary to complete the job though specifically not covered in the scope of work.

3. SCOPE OF WORK:

The scope of work includes Design, Supply, Installation, Testing & Commissioning of 25KWp (DC) Roof Top Solar PV Plant and Equipment including to and fro transportation of tools, tackles, men and machine as required for completion of the job as mentioned in the Schedule of Rates (SOR), Technical Specification, Bidder's Checklist.

The work shall conform to the latest applicable IS/IEC/Equivalent codes and to the satisfaction of Engineer In-Charge. Decision of EIC regarding acceptability of practices will be final & binding to the contractor. Mobilization and demobilization for the job will be in the scope of the contractor.

4. RECOVERY:

Cost of any damage/ loss of company property by the contractor shall be recovered; GAIL's decision in this regard will be final, binding & conclusive.

5. RATES:

a) The rates quoted by contractor shall include all liabilities such as supervision, wages, overtime, leave, bonus, increment, retrenchment compensation, insurance and all other statutory payments, including providing of tools and tackles, under contractor 's scope of supply, overheads, profits etc. for which no extra payment whatsoever will be made by GAIL.

b) The rates herein contained and agreed shall remain firm during the whole contract period and shall not be subjected to escalation or revision.

c) The quoted rates in accordance to the Schedule of Rates (SOR) and shall be inclusive of all duties, octroi etc. except GST (Goods & Services Tax). GST if applicable shall be paid extra. The bidder shall indicate in its bid the GSTIN No.

d) The contractor liable to pay GST for the works/ services rendered to GAIL, shall specifically mention the GSTIN in their Invoice (s). Further, amount and the rate of GST shall be separately and distinctly specified in the invoice(s).

For payment of GST, serially numbered invoice bill shall be issued by the service provider and should also specify the following.

i)The name, address and registration no. of the service provider.

ii)The name, address of the recipient of the taxable service.

iii)Description, classification and value of taxable service provided and the GST payable on such services.

The above details are required to enable GAIL to avail CENVAT credit for the GST payment.

6. COMPLETION PERIOD:

The completion schedule for all jobs under the Contact (i.e. Supply, Installation & Commissioning) shall be for 06 (Six) months, to be reckoned from the date of issue of Letter of Intent (LOI)/ Fax of Acceptance (FOA)/Letter of Acceptance (LOA).

MOBILIZATION PERIOD:

- Mobilization period shall be 15 days from the intimation given by EIC

7. MODE OF PAYMENT:

70% payment of total contract value will be released against the complete supply and installation of roof top solar PV power system at all 3 locations as per scope of work within 15 days.

20% payment of total contract value will be released after successful commissioning of Solar PV Plant completely in all respect at GAIL (India) Ltd. Vijaipur.

Remaining **10% payment** of total contract value shall be released after successful execution of all punch points observed by EIC and acceptance of total work.

8. WORK MEASUREMENT: "ANJANI" E-MEASUREMENT BOOK & E-BILLING PORTAL: -

Measurement book (MB) is an important application in which daily measurements are recorded for the work done by contractor in line with the SAP-Purchase Order. The recorded MB is sent for approvals to GAIL Site in charge (SIC) through the system where SIC can take decision to accept/ return/ partial accept.

On the basis of approved MB's, an Abstract is created by Contractor and again forwarded to SIC for 100% approval, and there after SIC forwards it to GAIL Engineer In-charge (EIC) for 15% approval of value of work done and subsequently it is forwarded to for approval of 5% of total work executed to GAIL HOD. After the approval of Abstract from GAIL HOD, Contractor is supposed to create the MOP (Memorandum of Payment) and after creation of the same, it is forwarded to SIC, subsequently to GAIL EIC and after that GAIL finance for review and acceptance.

Contractor payments are made based on the measurements recorded in the MB.

- Payment against Installation & Commissioning of the Solar PV Modules & PCU and Metering system shall be processed through E-measurement & E-billing module(e-ANJANI).

9. PRICE REDUCTION SCHEDULE:

The contractor shall have to carry out the all the jobs as per individual time schedule specified in the FOA/LOI/LOA and if the contractor fails to execute the SOR item within that specified time period, the contract value shall be reduced by @0.5% per week subject to maximum of 5% of the total contract price.

However, total Price Reduction Schedule charged on account of all of the above shall not be more than 5% of the total contract value.

The price reduction schedule is not a penalty but a pre-determined compensation for delay in work. The parties agree that this is a genuine pre-estimate of loss/damage which will be suffered on account of delay/breach on the part of the contractor and the said amount will be payable from the bill without there being any proof of the actual loss or damages caused by such delay/breach.

10. WARRANTY:

The complete Solar Power System must have warranty of Five (5) Years from date of commissioning of the Solar Power System at GAIL, Vijaipur.

11. DEFECT LIABILITY PERIOD:

The defect liability period for the contract will be Five (5) Years from the date of commissioning of the Solar Power System at GAIL, Vijaipur.

Any defect or damage discovered/observed in the work done/material supplied by the contractor within this period due to poor workmanship /material shall be rectified/replaced by the contractor free of cost or in case of default GAIL may get the same rectified/replaced by other agency and the expenses so incurred shall be deducted from the contractor's bill / security deposit. Decision of Engineer In- Charge will be final & binding to the Contractor.

12. RESPONSIBILITY OF CONTRATOR:

All expenses towards mobilizations at site and demobilization of equipment, work forces, materials, dismantling the equipment, clearing the site etc., shall be deemed to be included in the prices quoted and no separate payment on account of such expenses shall be entertained.

All entries and exits of materials and equipment's should be done with proper gate passes and records at the CISF security gate.

The contractor shall provide cotton dangri, safety shoes, and other Personal Protective equipment's to the personnel's deployed for the works. All the test and measuring instruments including consumables required to execute the job are in the scope of the Contractor.

Lodging & fooding of the persons deployed for the work has to be arranged by the contractor and GAIL will not provide such facilities. The cost of the same is deemed to be included in the quoted price.

It is understood that before quoting the rates, the contractor has visited the work site and has acquainted himself fully with the nature and quantum of work to be done.

13. GAIL'S SCOPE OF SUPPLY:

Electrical Power & Water at single point will be supplied by GAIL free of cost.

14. CONTRACTOR'S SCOPE OF SUPPLY:

All the materials required to carrying out the job as per SOR, Scope of Work & Technical Specification of Work shall be in contractor's scope of Contractor. General tools and tackles required should be arranged by the contractor to carry out the work as and when required by GAIL.

Supply of all the consumable materials such as PVC insulation tape, wires, cables & cable lugs etc. & all other special tools /tackles, required to complete the job shall be in the scope of the contractor. Hydra/Crane required for Erection of any of the equipment has to be arranged by the contractor.

It shall be entirely the contractor's responsibility to provide, operate and maintain all the necessary tools and rates quoted by contractor shall include the same.

Joint measurement book shall be maintained by contractor as per the agreed format which will be used as reference for payment to the contractor for the work done.

15. SUPERVISION OF WORK:

The contractor shall have one experienced supervisor. He should be able to manage site activities while executing the job at the site and guide his personnel to carry out the work as and when required as per the instructions of the Engineer In- charge. No extra payment will be made for providing supervisor.

In order to achieve desired workmanship and quality, the contract shall deploy experienced and competent personnel.

16. TRANSPORTATION / CONVEYANCE:

The contractor shall make his own arrangement for the transportation of his men and materials to the place of work on all the days and time

17. SUBLETING OF CONTRACT:

No part of this contract no any share or interest there in shall be in any manner or extent is transferred or assigned or sublet, directly or indirectly to any person/firm or organization whatsoever.

18. GATEPASS / IDENTITY CARD:

The contractor shall make / renew at his own cost gate pass/ identity cards if so required by GAIL/CISF for security or any other reasons. GAIL may only endorse such passes on recommendation of the contractor.

19. NUISANCE:

The contractor or his representative shall not at any time cause any nuisance on the site or do anything which may cause unnecessary disturbances to the owners or tenants or occupants or their properties near the site and to the public generally.

20. HSE REQUIREMENT

SCOPE:

These specifications establish the 'Health, Safety and Environment [HSE] Management' requirement to be complied with by the Contractors during executing their Job. Requirements stipulated in these specifications shall supplement the requirements of 'HSE Management' given in relevant act(s) / legislation(s).

20.1 REQUIREMENTS OF 'HEALTH, SAFETY AND ENVIRONMENT [HSE] MANAGEMENT SYSTEM' TO BE COMPLIED BY BIDDERS

20.1.1 Preferably, the Contract should have a documented 'HSE Policy' to cover commitment of their organization to ensure health, safety and environment aspects in their line of operations.

20.1.2 The Contractor shall ensure that the GAIL's 'Health, Safety and Environment [HSE]' requirements are clearly understood and faithfully implemented at all level, at sites.

20.1.3 Contractor shall promote & develop consciousness for health, safety & environment among all personnel working for the Contractor. Regular work-site meetings shall be arranged on 'HSE' activities to cover hazards involved in various operations during executing their jobs, location of First Aid Box, trained personnel to give First Aid, Assembly Points, standby Ambulance or vehicle and fire protection measures such as fire hydrant, water and fire extinguishers, etc.

20.1.4 Non-conformance of 'HSE' by Contractor [including his sub-Contractors] as brought out during review/audit by GAIL / external agency authorized by GAIL, shall be complied by Contractor and its report to be submitted to GAIL.

20.1.5 Contractor shall adhere consistently to all provisions of 'HSE' requirements. In case of non-compliance of continuous failure in implementation of any of the 'HSE' provisions, GAIL may impose stoppage of work and a suitable penalty for non-compliance. The decision of imposing work stoppage, its extent & monetary penalty shall rest with GAIL.

- 20.1.6 All fatal accidents and other personnel accidents shall be investigated for root cause by GAIL and Contractor shall extend all necessary help and cooperation in this regard. Recommend corrective and preventive actions of findings will be communicated to Contractor for taking suitable actions should be taken by the Contractors to avoid recurrence of such incidences.
- 20.1.7 Contractor shall ensure that all their staffs and workers, including their sub-Contractor(s), shall wear 'Personal Protective Equipments [PPEs]' such as safety helmets, safety shoes, safety belts, protective goggles, gloves, etc., as per job requirements. All these gadgets shall conform to relevant IS specifications or equivalent.
- 20.1.8 Contractor shall assign competent & qualified personnel for carrying out various tasks/jobs as per requirement.
- 20.1.9 All equipments should be tested and certified for its capacity before use.
- 20.1.10 Contractor shall ensure storage and utilization methodology of materials that are not detrimental to the environment. Where required, Contractor shall ensure that only the environment friendly materials are used.
- 20.1.11 All persons deployed at site shall be knowledgeable of and comply with the environmental laws, rules and regulations relating to the hazardous material substances and waste. Contractor shall not dump release or otherwise discharge or dispose off any such materials without the express authorization of GAIL.
- 20.1.12 Contractor should obtain all work permits before start of activities [as applicable] like hot work, confined space,

work at heights, storage of chemicals/explosive materials and its use & implement all precautions mentioned therein.
- 20.1.13 Contractor should display at site office and work locations caution boards, provide posters, banners for safe working to promote safety consciousness, etc.
- 20.1.14 Contractor should carryout audits/inspections/supervisions at the sub-Contractor's works and submit the reports for review by GAIL.

EIC is empowered to impose punitive fines on contractor for repetitive violation of safety rules & regulation of GAIL.

RELEVANT CODES FOR 'PERSONAL PROTECTION EQUIPMENTS'

IS: 2925 - 1984 Industrial Safety Helmets

IS: 47701 - 1968 Rubber Gloves for Electrical Purpose

IS: 6994 - 1973 [Part-I] Industrial Safety Gloves [Leather & Cotton Gloves]

IS: 1989 - 1986 [Part-II] Leather Safety Boots & Shoes

IS: 5557 - 1969 Industrial & Safety Rubber Knee Boots

IS: 6519 - 1971 Code of Practice for Selections, Care & Repair of Safety Footwear

IS: 11226 - 1985 Leather Safety Footwear Having Direct Molding Sole

IS: 5983 - 1978 Eye Protectors

IS: 9167 - 1979 Ear Protectors

IS: 3521 - 1983 Industrial Safety Belts & Harnesses

20.2 PUNITIVE FINES:

Punitive fines on contractors are imposed for repetitive violation of safety rules & regulations during execution of jobs. Objective of punitive fines is to work as deterrent for contractors in violation of safety rules & regulation and to improve safety atmosphere in general at all site.

Proposed guidelines for imposition are described below:

- 1) For first time violation of safety rules & regulation by any contractor, HOD (F&S) will issue a warning letter to contractor with intimation to OIC of work center and EIC.
- 2) In case of second time violation of safety rules & regulations by same contractor, OIC will call contractor in person and will have a meeting to discuss reason for repetitive violation along with EIC and HOD (F&S). A warning letter will also be issued by EIC to contractor.
- 3) In case of further violation, punitive fines will be imposed on contractor. Amount of fine will be decided as per severity of violation of safety. However, minimum fine would be Rs.10,000/- and in multiple of Rs.10,000/-, thereafter. This will be limited to 5% of contract value, as maximum cumulative penalty.

4) This practice of punitive fines is to be implemented across all Gail sites on those contracts having value of minimum Rs.10 Lacs and above or any other contractor for recurring operation or maintenance (AMC), irrespective of value.

21. INSURANCE & LIABILITIES:

The contractor agrees to and does here by accept full and exclusive liability for the compliance with all obligations imposed and further agrees to defend, indemnify and hold owner harmless for any liability or penalty which may be imposed by the central, state or local authority also from all claims, suits or proceeding that may be brought against the owner arising under growing out of the reasons of the work provided for by this contract whether brought by employees of the contract by third parties or any central government, state government or local authority for the following Act(s) and liability.

- a. Employees State Insurance Act.
- b. Workmen compensation & employees liability insurance.
- c. Any other insurance required under law or regulations or by owner.
- d. Accident or injury to workmen.
- e. Transit Insurance.
- f. Damages to property or to any third party.
- g. The contractor shall take insurance under workmen compensation act for all his workmen to be deployed for the work and submit a copy of the policy before commencement of work if awarded.

22. COMPLIANCES UNDER VARIOUS LABOUR LAWS:

The Service Provider has to fully comply with all applicable laws and regulations passed, modified and notified from time to time by the Central, State and local Government agencies/authorities. Specific attention of the Service Provider is drawn to the following obligations amongst others:

1. The Code on Wages, 2019

1.1. Minimum Wages:

- a. During the tenure of the contract, the Service Provider must ensure the payment of minimum wages, as notified by the Central Government or State Government whichever is higher, as per the provisions of the Minimum Wages Act, 1948 / Code on Wages, 2019. Further, any revision / upward escalation in the minimum wages specified by the Govt. shall be borne by the Contractor. No reimbursement towards the same shall be given by GAIL.
- b. **Wage period:** Wage period shall be monthly

1.2. Payment of Wages:

The Service Provider should disburse monthly wages through e-banking / digital mode through cashless transaction only, and avoid illegitimate deductions and maintained records /returns as

prescribed. The Service Provider shall be solely responsible for the payment of wages and other dues to the resources, if any, deployed by him latest by 7th day of the subsequent month as per the provisions of the Payment of Wages Act, 1936 / Code on Wages, 2019. After disbursement of wages, the representative of the Service Provider and EIC/ authorised representative of GAIL have to certify the payment of wages to the resources and sign the Wage Register - Form B (under The Ease of Compliance to Maintain Registers under various Labour Laws Rules, 2017) with specific seal detailing name/designation/Company.

1.3. Payment of Bonus:

Service Provider shall ensure payment of bonus as per the provisions of the Payment of Bonus Act 1965 / Code on Wages, 2019. Present minimum rate of payment of Bonus as per the Payment of Bonus Act, 1965 is 8.33% of minimum wages per month or 8.33% of Rs.7,000/- per month whichever is higher. The rate shall be subject to amendments made from time to time to the legislation.

In case the wages are above the prescribed wage ceiling under Payment of Bonus Act, 1965/ Code on Wages, 2019 may be paid at the rate of minimum Bonus i.e. currently @ 8.33% of minimum wages.

Payment of Bonus shall be made preferably before Deepawali festival falling after the end of relevant financial year(s) and the balance payment at the time of closure of contract.

The service provider shall provide copy of Form C & Form D as proof of payment of bonus and copy of bank transfer towards payment of amount by the service provider.

2. Leaves/ Leave with wages:

The Service Provider shall comply with all the applicable leave Rules including leave with wages in terms of Factories Act, 1948. As per Factories Act, 1948 Annual Leave with Wages @ 01 day for every 20 days of work performed by him in the previous calendar year. The Service Provider shall extend the leave with wages and maintain the Register of Leave pertaining to the resource deployed.

The payment towards un-availed leave, as per Factories Act, 1948 shall be settled with the resource at the time of closure of the contract or separation of resource or in the first month of the subsequent calendar year (whichever is earlier).

The service provider shall provide copy of Leave Wage Register as proof of payment of Leave wages and copy of bank transfer towards payment of amount.

3. The Employees Provident & Miscellaneous Provisions Act 1952

- a) The Service Provider shall have his own PF code no. with the RPFC as required under Employee PF & Miscellaneous Provisions Act, 1952.
- b) The Service Provider has to ensure compliance (as per prevailing rates) and extend benefits under Employees' Provident Fund Scheme 1952, Employees' Pension Scheme 1995 & Employees' Deposit Linked Insurance Scheme 1976 to the resources deployed by him.

- c) The Service Provider should submit copies of *separate e-Challans / ECR/proof of payment/receipt* in respect of resources engaged through this contract only, on monthly basis. **Common challans would not be acceptable in GAIL.** The Service Provider should submit copies of previous months EPF e-Challans / ECR along with current month's bill.
- d) **PF is mandatory irrespective of the number of resources deployed** by the Service Provider under this contract. PF membership and deposit of PF contribution is also mandatory even if the wage payment to the resource is exceeding the prescribed monthly wage ceiling under the EPF Act and in such case the liability of the Service Provider towards PF contribution shall be limited to the prescribed monthly wage ceiling notified from time to time.
- e) In case the Service Provider deploys any “**International Worker**”, the Service Provider should also make compliance under para 83 of EPF Scheme, 1952 i.r.o the “International Workers” and must register on the ***International Worker Portal of EPFO.***
- f) The condition of independent PF code is not applicable in case of Consultancy, Architectural, Actuarial, and Chartered Accountancy Services.

4. **The Employees Compensation Act 1923 (wherever applicable)**

In case the work place is out of the notified coverage area under ESIC i.e. ESIC is not implemented in the area **or** in case of excluded employees under ESIC, the Service Provider is required to take Employee Compensation / Workmen Compensation Policy from IREDA approved Insurance Company taking into consideration the **maximum compensation liability** as per provisions of Employee Compensation Act, 1923. The insurance premium charges for obtaining such policies shall be borne by the Service Provider.

5. **Group Personal Accident Insurance Policy**

The Service Provider to take a Group Personal Accident Insurance Policy with coverage of Rs.3 Lakhs per resource for the entire period of contract covering all resources deployed under the contract. The insurance premium charges for obtaining such policies shall be borne by the Service Provider.

6. **The Payment of Gratuity Act, 1972**

In case of Death or permanent disablement of a resource during execution of work under the contract, the Service Provider has to pay the Gratuity as per provision under the Payment of Gratuity Act 1972 to the nominee(s) of resource as per the details maintained in the duly signed Nomination Form maintained by the Service Provider. **The proof of disbursement may be submitted to the EIC for claiming reimbursement of amount paid towards death Gratuity from GAIL.**

7. **The Contract Labour (Regulation and Abolition) Act, 1970**

- a) The Service Provider is required to obtain Labour license under the provisions of the Contract Labour (R&A) Act, 1970 from the office of Licensing Officer, Central Labour Authority, Ministry of Labour and Employment, Govt. of India having jurisdiction of the Region.
- b) The Service Provider shall discharge obligations as provided under Contract Labour (R&A) Act, 1970 rules and regulations framed under the same and enforced from time to time.

- c) The Service Provider shall ensure regular and effective supervision and control over the resources deployed for which a supervisor / representative of the service provider should be available for giving suitable direction for undertaking the Contractual Obligations.
 - d) The Service Provider is solely responsible for payment of wages to each worker deployed by him and such wages shall be paid before the expiry of such period as may be prescribed.
 - e) It shall be the duty of the Service Provider to ensure the disbursement of wages to the contract labour within stipulated time.
 - f) In case the Service Provider fails to make payment of wages and deposit of PF contribution within the prescribed period or makes short payment of wages / short deposit of PF contribution, then GAIL, as Principal Employer, will make payment of wages in full or the unpaid balance due, as the case may be, to the resource deployed by the Service Provider and deposit the PF contribution with PF authorities. Such amounts will be recovered from the Service Provider either by deduction from any amount payable to the Service Provider under any contract or as a debt payable by the Service Provider.
8. The Contractor should also fully comply with all applicable laws and regulations including, but not limited to the following legislations:
- a) The Factories Act, 1948 or The Shops & Establishment Act, 1948
 - b) The Industrial Dispute Act, 1947
 - c) The Maternity Benefit Act, 1961
 - d) The Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act 1979 & Building and Other Construction Workers Welfare Cess Act, 1996
 - e) The Inter State Migrant Workmen (RECS) Act 1979 (if applicable)

9. In case of Overtime work, Contractor is required to compensate the workers in line with the Overtime rates applicable vide Section 59 of the Factories Act, 1948.

It is construed that while bidding the Bidder is taking into account the provision for Overtime. No reimbursement on the account of Overtime shall be given by GAIL.

23. Unless otherwise specifically mentioned in the Special Conditions of Contract, the Contractor shall bear any upward revision in the rate of Minimum Wages, including but not limited to any kind of unprecedented or steep hike over and above the half yearly revisions of variable dearness allowance from time to time at its own cost during the Contract Period.
24. All other terms and conditions shall be as per GCC of Tender Document.

SECTION-VI

SCOPE OF WORK [SOW]

SCOPE OF WORK/SUPPLY & TECHNICAL SPECIFICATIONS

1.0 General Information

1.1 The Scope of Work includes but not limited to Design & Engineering, Procurement & Supply of Equipment and Materials, Testing at manufacturers works, Inspection, Packing and Forwarding, Supply, Receipt, Unloading and storage at site, carrying out associated Civil works, Services, Permits, Licences & Statutory clearances, Installation and Incidentals, Insurance at all stages, Erection, Testing and Commissioning of 25kWp (Location-1:-NFL terminal-Viajipur) & 25 kWp (Location-2 :-NTPC Anta) & (Location-3 :- Chittorgarh terminal) Grid Interactive Solar PV Power Plant and performance demonstration with associated equipment and materials along with associated Distribution system (By means of Cables using the existing route wherever possible otherwise, similar cabling arrangement should be made in the missing portion of the cable route) up to 415V Electrical Power Panel of the GAIL (India) Limited, at our respective terminals.

1.1 Site Description

Particulars	Description
Details of proposed capacity of the Solar powerplant.	<ol style="list-style-type: none">25 KWp DC Grid Connected Rooftop SPV Power Plant. Location –NFL Terminal Vijaipur25 KWp DC Grid Connected Rooftop SPV Power Plant. Location – NTPC-Anta terminal25 KWp DC Grid Connected Rooftop SPV Power Plant. Location -Chittorgarh Terminal
Power system	415Vph-ph -TPNsystem(Neutral solidly grounded)
Village	<ol style="list-style-type: none">Vijaipur for NFL TerminalAnta for NTPC TerminalChittorgarh for Chittorgarh terminal
District	<ol style="list-style-type: none">Guna district for NFL terminalBaran district for NTPC AntaChittorgarh district for Chittorgarh terminal
State	<ol style="list-style-type: none">Madhya Pradesh for NFL-terminalRajasthan for both NTPC-Anta & Chittorgarh
Location (ProjectSite)	<ol style="list-style-type: none">NFL Terminal VijaipurNTPC-Anta terminalChittorgarh Terminal
Evacuation system	Through LT cable

Water and Power for Construction	Employer will provide the construction water and power free of cost as per the requirement of the Bidder during construction/ execution period. However, the Bidder is advised to avoid Wastage of Water and power. Power shall be provided by the Employer at single point.
Rooftop	Flat but with water proof system. No damage to rooftop waterproof system will be allowed.

2.0 Design of Complete Plant and Sub-Systems:

- 2.1** The scope of the bidder includes complete System Design and Engineering, Finalization of Drawings/ Documents, Submission of Engineering Drawing / Documents and Processing of their approvals by GAIL. Initially contractor shall submit design basis report along with preliminary design showing General System Layout within 15 days from LOA for in principle approval of Engineer In-Charge (EIC). The detailed design shall be submitted by contractor within one month from the date of LOA.
- 2.2** The scope shall include submission in proper shape & format, all the Drawings including Engineering drawings, Sizing calculation, Data sheet, Test procedures, Equipment layout, Drawings/Data sheets of all the equipment/materials under Scope of Supply, Civil structural/architectural drawings prepared by structural engineer, Load bearing capacity details, detailed design drawings of Earthing system, Lightning system, Inverter etc., Manuals including O&M Manuals, Control System Manuals with details of Error/ fault code, Handbooks of equipment like Inverter, MPPT Charge Controller, PV module etc. and any other required design documents covered under Technical Specifications in requisite numbers at different phases of the project as per the requirement of GAIL.
- 2.3** Contractor shall design their SPV panel structure according to wind load (180 km/hour) and concrete flat roof. Contractor shall also explore the design so that PV Module will have the self-cooling effect to improve the performance. Load bearing strength of Roof top of NFL Terminal and NTPC Anta terminal & Chittorgarh terminal and its suitability for installing Solar PV plant, Design of SPV structure and Distribution of load on roof shall be inspected by structural engineer and structural design need to be vetted by structure engineer/consultant. Any changes in structural design suggested by EIC shall be binding on the contractor.
- 2.4** Bidder shall obtain approval from relevant statutory authorities in respect of design, single line diagram, plan, clearance etc. as mandatorily required by respective authorities in respect of such works.

2.5 Installation (including Civil works):

The scope of the contractor shall be, including but not limited to the following:

- i) Installation of suitable nos. of Solar Photo Voltaic (SPV) modules with power rating of 250 Wp and above.
- ii) Installation of Module mounting structure (MMS) for mounting of Solar PV module at roof top of building.
- iii) Installation of Junction Boxes.
- iv) Installation of Power Conditioning Unit (PCU).
- v) Installation of String Level Monitoring (SMUs) system if any.
- vi) Installation of LT switchgears as per system requirement.
- vii) Laying of cables on prefabricated GI cable trays and/or within suspended ceiling spaces including cable trays, hangers, supports, cable terminations, all fixing accessories wherever required. Existing cable trays in the area would be used mostly. However, at some places new cable trays would be required which shall also require additional cable tray supports on the existing cable tray structure by contractor as per standard specifications.
Laying of cables in cable trenches including providing MS cable markers, backfilling the trenches, Making straight through joints using heat shrinkable sleeves for cables or as per applicable norms wherever required, connection, termination and testing of cables to distribution boards, Proper sand bedding must be provided. Existing cable trenches in the area would be used mostly where control and power cables to be laid. However at some places new cable trenches would be required which is to be made by contractor as per standard specifications. Road crossings, if required, shall be made by trenchless methods and open cutting shall be avoided. Suitable protection i.e. Hume pipe of suitable grade.
- viii) Interconnection of Solar PV Power Plant with the LT Lighting Distribution Board, which includes installation of cables as evacuation line with associated equipment and materials so as to export power from Solar PV power plant to LT Power Panel of GAIL'S Switchgear room.
- ix) Installation of Digital Multi-Function Meter of Import/Export type
- x) Installation of Earthing system with testing joint for every pit (grounding) system including cutting of roads / paved areas / PCC floor etc. and making as good as in original shape.
- xi) Installation of Lightning arrester and all other protection equipment. If Required
- xiv) Installation of PV Module water washing/cleaning system with necessary pump & piping arrangement.
- xv) Provision for other things that may require for successful Operation and Maintenance of plants and equipment.

- xvi) All Civil works required for proper installation of complete SPV system shall be in the scope of contractor.
- xvii) Synchronization of Solar system with LT Power Panel of Switchgear Room and carry out the inter connection prior to the final commissioning of the Solar PV Power Plant.
- xviii) Fixing of Danger notice plates shall be provided at prominent locations.

2.6 Commissioning:

- i) After installation of all equipment, vendor shall perform commissioning checks to verify the correctness and proper operation of all equipment in all respects. In addition the vendor shall carry out all other checks and tests recommended by the manufacturers. During the trial operation, SPV plant shall perform trouble-free operation for cumulative 24 hours during which functionality of all plant components shall be demonstrated by the vendor and the system shall be in Generating Mode.

2.7 Approvals: Obtaining statutory approvals /clearances on behalf of the GAIL from various Government Departments not limited to the following:

- a) Pollution control board clearance, if required.
- b) CEA, State Electricity Board and other statutory authorities for obtaining clearances for setting up of Solar PV Plant.
- c) All other statutory approvals and permissions, not mentioned specifically but are required to carry out hassle free Construction and O&M of the Rooftop SPV plant.

2.8 Warrantee:-

The Complete Solar Power System shall have warrantee of **5 Years** from date of commissioning, if any fault occurs during this period contractor shall attend without any cost implication to GAIL

A. **Scope of Supply:**

The equipment and materials for Rooftop Solar PV Power Plant with associated system shall be including but not limited to the supply of the followings:

- i) Solar PV Modules
- ii) Module Mounting Structures (MMS)
- iii) Power Conditioning Units including Maximum Power Point Tracker (MPPT)
- iv) Cables including power and control cables and accessories
- v) Protection equipment like Circuit Breakers, Solar Array Fuses, Earthing and Surge Protection System and Lightning Arrester etc.
- vi) Adequate provisions shall be kept for Cable placement with appropriate cable ties for holding the cable in place during the windy condition, including selection of correct size of fuse to avoid fire risk.
- vii) All Earthing related equipment. Design of Earthing systems should avoid breaching the building

- envelope and damaging either the water proofing system or building electrical system.
- viii) Junction boxes / SMU.
 - ix) Multi-Function Digital Meter with Modbus Protocol.
 - x) Mandatory spares.
 - xi) Tools and Tackles, Caution Boards.
 - xii) Applicable Type Test Certificates of all the equipment which are under the scope of material supply
Adequate numbers of stairs and arrangements of walk way on the roof top so that technicians can visit the roof top Solar PV plant for the purpose cleaning, routine checkup etc.
 - xiii) Water supply Arrangements on the rooftop for Module cleaning etc.
 - xiv) All safety gadgets during Construction period including but not limited to, rubber mats of appropriate grade, PPE, rubber gloves and shoes etc.
 - xv) Any other equipment / material required to complete the Rooftop Solar Power Plant.

C. Technical Specifications:

1.0 General:

In Grid connected Roof top system, the DC power generated from Solar PV (SPV) panel is converted to AC power using Power Conditioning Unit and is fed to the Grid through 415V three phase system depending on the capacity of the system installed at all the three locations of GAIL Terminals

These systems generate power during the day time which is utilized fully by the connected loads. In case, where solar power is not sufficient due to cloud cover etc., the connected loads are served by drawing power from the Grid.

1.1 Islanding Protection:

In case the Grid fails, the back fed of Solar power to the Grid has to be stopped immediately so as to safe-guard any person/technician working in Grid line from getting electrocuted while working on the grid for maintenance.

1.2 System Components:

A grid-connected Solar PV system shall consist of the following main components:

- a) Solar PV (Photo-voltaic) array.
- b) Solar PV array support structure.
- c) Solar Grid inverter.
- d) Import/Export type Digital Energy Meter
- e) Protection devices
- f) Cables (Power and control)
- g) ACDB/PDB suitable for 25KW systems for solar power distribution

1.3 Applicable Standards:

Components and parts used in Solar PV systems should conform to the BIS or IEC or other International standards/specifications, wherever such standards/specifications are available and applicable.

2.0 Specification of Solar PV Modules:

Total capacity of PV Modules to be supplied for the **25 kWp (DC)** system is the cumulative rated capacity of all solar PV module under supply as per relevant IEC standards under Standard Test Condition (STC). Detailed specifications of the solar PV modules are given below:

Type of SPV module	Crystalline silicon
Origin	Manufactured in India

Nominal PowerOutput	Shall not be less than 250Wp at Standard Test Conditions (STC) with positive tolerance only (+5 W)
---------------------	--

Module Efficiency	≥15%
Number of cells	Minimum 60
Fill Factor	≥72%
Glass for the Crystalline Silicon Modules	Toughened low iron glass with minimum thickness of 2.5mm
Transmittance of the Glass	Above 90% and with bending of less than 0.3%
Back sheet	The back sheet used in the crystalline silicon based modules shall be 3 layered structures. Outer layer of fluoropolymer, middle layer of Polyester (PET) based and Inner layer of fluoropolymer or UV resistant polymer. Back sheet with additional layer of Aluminium also will be considered. The thickness of back sheet should be of minimum 300 microns with Water vapor transmission rate less than 3g/m ² /day. The Back sheet shall have voltage tolerance of more than 1000 V. Alternatively the backsheet can also be made of Toughened low iron glass with minimum thickness of 2.5mm.
EVA	The Ethylene Vinyl Acetate used for the modules should be of UV resistant in nature. No yellowing of the back sheet with prolonged exposure shall occur.
Sealant	The sealant used for edge sealing of PV modules shall have excellent moisture ingress protection with good electrical insulation (Break down voltage >15 kV/mm) and with good adhesion strength.

Termination/Junction Box	The junction box used in the modules shall have protective bypass diodes to prevent hot spots in case of cell mismatch or shading. The material used for junction box shall be made with UV resistant material preferably Thermo-plastic to avoid degradation during module life and the junction sealing shall comply IP65 degree of protection.
Blocking diodes	Schottky type
PID free modules	The Crystalline Silicon based modules supplied should be of Potential Induced Degradation (PID) free modules and the test certificate from third party lab complying with the same shall be provided.
Wind Speed	Modules should have rugged design to withstand tough environmental conditions and high wind speeds (minimum up to 180 km/h).
Humidity and Temperature	Modules shall perform satisfactorily in relative humidity up to 95% and temperature between -10°C and 85°C (module temperature).
Degradation warranty	Panel output (Wp) capacity to be $\geq 90\%$ of design nominal power after 10 years and $\geq 80\%$ of design nominal power after 25 years.
Warranty	The modules shall be warranted for minimum of 10 years against all material/manufacturing defects and workmanship.
Temperature coefficient	$\leq -0.45\%/^{\circ}\text{C}$ for P_{max}
Module Mismatch	The module mismatch of the modules connected to an inverter should be less than 2%.
Module frame	The module frame shall be made of anodized Aluminum or corrosion resistant material, which shall be electrically compatible with the structural material used for mounting the modules. The anodizing thickness shall be 15 micron or better. In case of metal frames are used for modules, it is required to have provision for earthing to connect it to the earthing grid.

Safety	SPV module shall have module safety class- II and should be highly reliable, light weight and must have a service life of more than 25 years.
Identification tag	<p>Identification tag for each solar module shall be provided inside/outside the module and must be able to withstand environmental conditions.</p> <p>Identification tag data:</p> <ul style="list-style-type: none"> a) Name of the manufacturer of PV Module b) Month and Year of manufacture c) Country of origin d) Wm, Imp, Vmp for the module e) Unique Serial No and Model No of the module

- 2.1 The Contractor would be required to maintain accessibility to the list of module IDs along with the parametric data for each module.
- 2.2 Modules only with the same rating and manufacturer shall be connected to any single inverter.
- 2.3 The modules shall be free from Micro cracks & snail trails.
- 2.4 Applicable Standards:
 - i) IEC 61215 2nd Ed. (Design qualification and type approval for Crystalline Si modules)
 - ii) IEC 61730 (PV module safety qualification testing @ 1000 VDC or higher)
 - iii) IEC 61701: Salt Spray test for highly corrosive environment, if applicable
 - iv) IEC 62716: Ammonia Resistant certified, if applicable
 - v) Test certificate from NABL approved or /ILAC member body certified labs shall be provided.

3.0 Solar PV Modules Mounting Structure:

The PV modules shall be mounted on fixed metallic structures having adequate strength and appropriate design, which can withstand the load of the modules and high wind velocities as mentioned above. The support structure shall be hot dip galvanized steel.

Detailed specifications for the mounting structure is given below:

- a) The support structure design shall be designed with reference to the existing roof conditions in order to withstand wind speed applicable for the zone (Site Location) or 180kmph, whichever is higher, using relevant Indian wind load codes.

- b) The structure must be designed with considering appropriate factor of safety, geographical condition, regional wind speed, load bearing capacity of roof, slope stability etc. The bidder must provide the detailed design and calculation for the structure design.
- c) The structure shall be designed for simple Mechanical and Electrical installation. It shall support SPV modules at a given orientation & tilt, absorb and transfer the mechanical loads on the trusses of the roof properly. Welding of structure at site shall not be allowed. Bidder shall submit a structure design for the approval of EIC.
- d) The array structure on the roofs shall be so designed that it will occupy minimum space without sacrificing the output from SPV panels. The structure shall be designed to allow easy replacement of any module by authorized personnel and shall be in line with the site requirements. Contractor shall also ensure that the sufficient space shall be left in between solar array on the roofs of both the locations for physical movement by O&M personnel.
- e) Structure material: The module mounting structure members should be made of hot dip galvanized MS profiles/ hot rolled/ cold formed steel sections. Galvanization thickness shall be of min 80 micron. Galvanization of the mounting structure shall be in compliance of latest edition of IS 4759.
- f) The yield strengths shall be as per relevant standards. All nuts & bolts, fasteners, panel mounting clamps etc. shall be made of very good quality stainless steel of grade SS 304 or higher. Nut & bolts, supporting structures including module mounting structures shall have to be adequately protected against all climatic condition and all galvanic corrosion at contact point of dissimilar metals
 - a) Chipping & anchor fastening at rooftop for better support of module mounting structure is allowed but bidder shall have to do re-waterproofing. Bidder to ensure that roof strength does not reduce after mounting solar PV modules.
 - b) Mounting arrangement for RCC-flat roofs: As per engineering calculation and design.
 - c) Installation: The structures shall be designed for simple mechanical on-site installation. There shall be no requirement of welding or complex machinery at the installation site.
 - d) Minimum distance between roof edge and mounting structure: 1200 mm.
 - e) The minimum clearance of the lowest part of the module structure and the flat concrete shall be 300 mm.
 - f) Access for panel cleaning and maintenance: All solar panels must be accessible from the top for cleaning and from the bottom for access to the module- junction box.
 - g) The structure shall be designed to allow easy replacement of any module and shall be in line with the site requirements.
 - h) Panel tilt angle: Suitable orientation with a fixed tilt minimum at angle of 21-25 degrees (depending on location).
 - i) Load bearing strength of roof top of Control building and its suitability for installing Solar PV plant, design of SPV structure and distribution of load on roof top beam shall be vetted by chartered structural engineer. Any changes in structural design suggested by EIC shall be binding to the contractor.

3.1 Applicable Codes & Standards: The system and equipment shall be designed, built, tested and installed in accordance with the latest revisions of the following applicable standards. In the event of other standards being applicable they will be compared for specific requirement and specifically approved during detailed engineering for the purpose:

IS 875: Code of practice for design loads (other than earthquake) for buildings and structure.

IS 800: Code of practice for general construction of steel.

IS 1893: Criteria for earthquake resistant design of structures -General provisions and buildings.

IS 513: Cold-rolled low carbon steel sheets and strips.

IS 814: Covered electrodes for manual metal arc welding of carbon and carbon manganese steel.

IS 733: Specification for Wrought Aluminum and Aluminum alloy Bars, Rods and Sections (for General Engineering Purposes).

IS 1868: Anodic Coatings on Aluminum and its Alloys.

IS 5523: Methods of Testing Anodic Coatings on Aluminum and its alloy.

IS 4759: Hot-dip zinc coatings on structural steel and other allied products. IS 2062: Hot rolled medium and high tensile structural steel – specification.

IS 808: Dimensions for hot rolled steel beam, column, channel and angle sections.

IS 811: Specification for cold formed light gauge structural steel sections. The bidder shall specify installation details of the solar PV modules. The support structures with lay-out drawings and array connection diagrams. The work shall be carried out as per the designs approved.

IS 811: Specification for cold formed light gauge structural steel sections.

The bidder shall specify installation details of the solar PV modules and the support structures with lay-out drawings and array connection diagrams. The work shall be carried out as per the designs approved.

4.0 Power Conditioning Unit/ Solar Grid Inverter:

Power Conditioning Unit (PCU) shall consist of Inverter along with associated Control & Protection, Filtering, Measuring instruments etc. The PCU shall be designed to convert the DC power of the solar PV module to Grid compatible AC power supply. The PCU shall be capable to adjust the output Voltage & Frequency to suit the Grid condition. The rated power/name plate capacity of the inverter shall be the AC output of the inverter at 500 C.

The detailed specifications of the Solar Grid Inverter are given below.

Output power	a) Minimum 25kW for all the Locations
Input DC voltage range	As required for the Solar Grid inverter DC Input
Operating AC voltage	Three phase 415V (+ 15%, -20%) as per design requirement
Operating Frequency range	47.5 – 52.5 Hz
Nominal Frequency	50 Hz
Inverter efficiency	≥95%
Power Factor	≥0.98 at nominal power
Total Harmonic Distortion	3% for Voltage 5% for Current
Built-in Protection	a) Over current b) Sync loss c) Over temperature d) AC/DC bus over voltage e) Cooling Fan failure (If provided) f) Short circuit g) Lightning h) Earth fault i) Surge voltage induced at output due to external source j) Power regulation in the event of thermal overloading k) Integrated protection in the DC and three phase system
Charge controller	MPPT Charger controller along with necessary software & hardware
Anti-Islanding protection	Required
Degree of Protection	IP65 for outdoor mounting, IP42 for indoor mounting
Communication interface Display type	RS 485 / RS 232 / RJ45 LCD/LED for data display. LCD / LED for status display
Operating ambient temperature range	status display
Humidity	0°C to +50°C
Cooling Flicker	0 – 95% Rh
Maximum noise level	Convection/ Forced Air cooling As per

	IEC 61000
	75 dBA

- 4.0** The inverters supplied shall have minimum of 10% additional DC input Capacity.
- 4.1** PCU must have provision to be isolated from Grid through Circuit breakers which shall be inbuilt with in the inverter or located in separate standalone panel.
- 4.2** Dimension, weight, cooling arrangement etc. of the PCU shall be indicated by the vendor in the offer. Type (in-door & out-door) of installation also needs to be indicated.
- 4.3** PCU shall confirm to IEC 61000 or equivalent international standard for compliance to requirements for Electromagnetic compatibility and to IEC 60068-2 or equivalent international standard for requirement of environment testing.
- 4.4** The minimum European efficiency of the inverter shall be 95% as per IEC 61683 standard for measuring efficiency. The vendor shall specify the conversion efficiency of different loads i.e. 25%, 50%, 75% and 100% in its offer. The vendor should specify the overload capacity in the bid.
- 4.5** The PCU shall remain connected to the grid as per Central Electricity Authority (CEA) Technical (standards for connectivity to the grid) Regulation 2007 with all latest amendments and its components shall be designed accordingly.
- 4.6** The PCU shall have protection against any sustained fault, lightning discharge in feeder line and earth leakage faults.
- 4.7** The incoming DC feeder of PCU shall have suitably rated Isolators to allow safe Start up and Shut down of the system and its terminals should be shrouded. The DC feeder shall terminate in the fuse box through suitable fuse rating. The PCU fuse box shall have one spare terminal with fuse and holder for future use. The connection between the fuse box and inverter shall be through copper bus bars or copper cable.
- 4.8** 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 desired life expectancy of the inverter.
- 4.9** The PCU shall have anti-islanding protection as per IEC 62116 or equivalent international standard. The PCU must synchronize automatically its AC output to the exact AC voltage and frequency of the captive bus. Inverters shall continuously monitor the condition of the captive bus and in the event of captive bus failure, the inverter automatically switches to off-grid supply within 20-50 milliseconds. The Solar system is synchronized with the captive bus immediately after the restoration of captive bus.
- 4.10** In case of Grid failure, the PCU shall be re-synchronized with Grid after revival of power supply. Vendor to furnish the time taken by PCU to be re-synchronized after restoration of Grid supply and the same to be indicated in data sheet to be submitted during detail engineering stage.
- 4.11** PCU shall confirm to IEC 62109 or IEC 62103 or equivalent international standard for compliance to requirement for the design and manufacture of PCU for protection against electric shock, fire,

mechanical and other hazards.

- 4.12** Control and read out should be provided on the indicating panel which is the integral part of the inverter. Display should be simple and show all the relevant parameter relating to PCU operational data and fault condition in form of front panel parameter/LED or two line LCD display. It shall include all important parameter i.e. DC input voltage, AC output voltage, AC output current, AC output power, Frequency etc.
- 4.13** The PCU shall be equipped with appropriate self-protective and self-diagnostic feature to protect it self and 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 when the PCU, including commutation failure, shall be cleared by the protective device.
- 4.14** The PCU design shall be such that it will not excite any resonant condition in the system that may lead to islanded operation of PV plant and loss of generation.
- 4.15** PCU shall have inbuilt control feature for changing output set point automatically to have real time control over the total power exported to the grid. In addition, operator shall be able to limit the total power (active and reactive) injected in the grid through manual intervention as and when required for grid security.
- 4.16** The inverters shall have minimum protection to IP65 (Outdoor)/IP42 (indoor) and Protection Class II.
- 4.17** Nuts & bolts and the PCU enclosure shall have to be adequately protected taking into consideration the atmosphere and weather prevailing in the area.
- 4.18** The inverter output shall always follow the grid in terms of voltage and frequency. This shall be achieved by sensing the grid voltage and phase and feeding this information to the feedback loop of the inverter. Thus control variable then controls the output voltage and frequency of the inverter, so that inverter is always synchronized with the grid. The inverter shall be self-commutated with Pulse Width Modulation (PWM) technology.
- 4.19** PCU/Inverter shall provide 3 phase, 415V (with captive bus tracking of +15%/- 20%), 50 Hz (with captive bus tracking of $\pm 5\%$ i.e. 47.5 to 52.5 Hz) supply on AC side with voltage THD of less than 3% and current THD of less than 5%. Captive bus voltage shall also be continuously monitored and in the event of voltage going below a preset value and above a preset value, the solar system shall be disconnected from the captive bus within the set time.
- 4.20** The PCU must have the feature to work in tandem with other similar PCU's and be able to be successively switched "ON" and "OFF" automatically based on solar radiation variations during the day. Inverters must operate in synergy and intelligently to optimize the generation at all times with minimum losses.
- 4.21** The PCU shall be capable of controlling power factor dynamically.
- 4.22** DC injection should be less than 0.5% of nominal load current.
- 4.23** Maximum power point tracker (MPPT) shall be integrated in the Power Conditioner Unit to maximize energy drawn from the Solar PV array. The MPPT should be microprocessor based to minimize power losses. The details of working mechanism of MPPT shall be mentioned by the vendor in

its offer. The MPPT unit shall conform to IEC 62093 for design qualification. The operating voltage range of PCU and the MPPT shall be large enough such that it satisfactorily operates for PV modules exposed to the maximum ambient temperatures of 50°C.

- 4.24** The system shall automatically “wake up” in the morning and begin to export power when there is sufficient solar energy and the grid voltage and frequency is in range.
- 4.25** Automatic sleep mode shall be provided so that unnecessary losses are minimized at night. The power conditioner must also automatically re-enter standby mode when threshold of standby mode reached.
- 4.26** Standby mode: The control system shall continuously monitor the output of the solar power plant until pre-set value is exceeded & that value to be indicated.
- 4.27** Basic System Operation (Full Auto Mode): The control system shall continuously monitor the output of the solar power plant until pre-set value is exceeded & that value to be indicated.
- 4.28** PCU shall have provisions/features to allow interfacing with monitoring software and hardware devices.
- 4.29** DC side of each inverter shall be earthed to distinct earth pit through adequate size of conductor/ earth strip as per IS 3043 -1987. The size of conductor / procedure for earthing shall be as per the maximum fault current of DC system.
- 4.30** The PCU should be provided with sinusoidal current modulation with excellent dynamic response.
- 4.31** Over voltage protection against atmospheric lightning discharge to the PV array is required.
- 4.32** The power conditioner must be entirely self-managing and stable in operation.
- 4.33** A self-diagnostic system check should occur on start up. Functions should include a test of key parameters on start up.
- 4.34** PCU/inverter front panel shall be provided with display (LCD or equivalent) to monitor, but not limited to the following:
 - a) DC power input
 - b) DC input voltage
 - c) DC Current
 - d) AC power output
 - e) AC voltage (Phase-Phase & Phase-Neutral)
 - f) AC current (Phase-Phase & Phase-Neutral)
 - g) Cumulative energy
 - h) Power Factor

4.35 Applicable Codes & Standards: PCU shall conform to the following standards and appropriately certified by the labs.

Efficiency measurement: IEC 61683

Environmental Testing: IEC 60068-2 or IEC 62093 EMC, Harmonics, etc.: IEEE 519

Electrical safety: IEC 62109 (1&2), EN 50178 or equivalent

Recommended practice for PV – Utility interconnections: IEEE standard 929
– 2000 or Equivalent

Protection against islanding of grid: IEEE1547/ UL1741/ IEC 62116 or equivalent

Grid Connectivity: Relevant CEA/ CERC Regulation and Grid code (amended up to date)

Reliability test standard: IEC 62093 or equivalent

5.0 DC Combiner Box:

A DC Combiner Box (FRP/Powder coated) shall be used to combine the DC cables of the solar module arrays with DC fuse protection for the outgoing DC cable(s) to the DC Distribution Box (IP should be suitable for outdoor protection). The cables from the array strings to the Solar Grid Inverters shall be provided with DC fuse protection. Fuses shall have a voltage rating and current rating as per design requirement. The fuse shall have DIN rail mountable fuse holders and shall be housed in suitable minimum IP 65 enclosures with transparent covers. Solar array fuses should be of appropriate rating.

6.0 DC Distribution Box (DCDB)/String Monitoring Unit:

6.1 DCDB/SMU shall have protection devices to protect the PV modules from current/voltage surges. DCDB/SMU should be capable to monitor the String/sub- array currents, Array voltage and Total current of all the strings connected to DCDB/SMU.

6.2 Applicable Codes & Standards: DCDB/SMU shall conform to the following standards
UL 94 V: Fire Resistant/ flammability

UL 746C: UV Resistant

IEC 62262: Mechanical Impact Resistance IS 2147/IEC 60529: Enclosure Protection
IEC 61643-12: Surge Protection

IEC 62208: Enclosure for low voltage Switchgear and control gear assemblies

6.3 The detailed specification of the DCDB/SMU is mentioned below:

Rated Current, IEC (90 °C)	30A(4MM2,6MM2)-40A(10MM2)
Rated Voltage	1000 Volts
Connector Design	Snap-In lockingType
Degree ofProtection	IP 65 or better
Protection/Safety Class	Class II
Contact material	Cu
Contact surfacematerial	Ag
Contact resistance for plug connector	<0.5 mΩ
Stripping length	10mm
In-flammability class	According to UL 94 UL94-V0 PPE/Noryl (PPE+PS material)
Insulating Material	VDE 670/TUV, UL 3
Certification	Class II
Pollution degree	

6.4 TheDC DistributionBox/SMUshallminimumcompriseofthefollowing components

- a) IncomingpositiveandnegativeDCcablesfromtheDCCombinerBox.
- b) DC circuit breaker, 2 pole (the cables from the DC Combiner Box will be connected to this circuit breaker on the incoming side) disconnect the PV strings from the Inverter for maintenance purpose. As an alternative to the DC circuit breaker aDCisolatormaybeused inside theDCDistributionBoxorinaseparate external IP 65 enclosure adjacent to the DC Distribution Box. If a DC isolator is used instead of a DC circuit breaker, a DC fuse shall be installed inside the DC Distribution Box to protect the DC cable that runs from the DC DistributionBox to the Solar Grid Inverter.
- c) Stringfuses(oneforeachstring)topreventthereversecurrentflow.
- d) DC Surge Protection Device (SPD), class 2 as per IEC 60364-5-53 for protection against surge currents and voltages.
- e) CurrentandVoltage measurementshallbeshuntbasedsensors.

6.5 The following parameters shall be available for monitoring the health of the each PV string:

- a) String(s)Current.

- b) Voltage of DC DB.
- c) Total current of DC DB.
- d) Total Power of DC DB.
- e) Status of Disconnect Switches and MOVs.

6.6 In order to provide protection to all cables and modules, suitable size of string fuses shall be provided to avoid fire hazard in positive legs of the string cabling. However, in case of negative grounded inverters, string fuse shall be provided in positive leg only as per recommendation of inverter manufacturer. String fuses shall be of PV category and dedicated to solar applications and conform to IEC 60269-6 or UL-2579 standards. String fuses should be so designed that it should protect the modules from reverse current overload.

6.7 Enclosure:

- a) The enclosure shall be fire retardant with self-extinguishing property.
- b) Degree of protection for enclosure shall be IP 65 or better.
- c) The enclosure shall be UV protected.
- d) The mechanical impact resistance of enclosure shall be IK07 or better.
- e) The size of the enclosure shall be designed in such a way that the temperature rise of the enclosure should not more than 30°C above the ambient temp of 50°C

A. The components mounted inside the DCDB/SMU shall have higher temperature withstand capability and shall continuously operate under such conditions without degrading the performance parameters and life expectancy.

Vendor shall furnish the design calculation for temperature rise for GAIL's approval.

f) In each DCDB/SMU 5% spare terminals (along with cable glands) rounded off to next higher integer shall be provided to connect the PV strings.

g) All terminals blocks shall be rated for min 1000V and rated continuously to carry maximum expected current.

h) In case, DCDB/SMU is proposed to be mounted on the Module Mounting Structure, the additional load of the DCDB/SMU shall be considered for the design of structure.

i) All internal wiring shall be carried out with 1100V grade stranded copper wires. 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.

- 6.8 DC Plug-In Connectors for Field Cabling: Cable connector to be used for connecting SPV modules and String monitoring boxes shall be in accordance with DIN EN 50521. Connector shall be of plug and socket design to be plugged together by hand but can be separated again using a tool only.

7.0 AC Distribution Box/PDB:

An AC distribution box/PDB shall be mounted close to the Power Conditioning Unit/ Solar Grid Inverter. The AC distribution box shall minimum comprise of the following components and cable terminations:

- a) Incoming 3.5/4 core cable from the Solar Grid Inverter,
- b) AC Circuit Breaker, 4-pole,
- c) AC Surge Protection Device (SPD), class 2 as per IEC 60364-5-53,
- d) Outgoing Cable to the building Lighting distribution board.
- e) Import/Export type Digital Multi-Function Meter.

8.0 Connection to the Power panel System:

The Final AC output of the Solar Grid Inverter shall be connected to the Power Panel or Lighting DB as per direction of the EIC.

9.0 Cables:

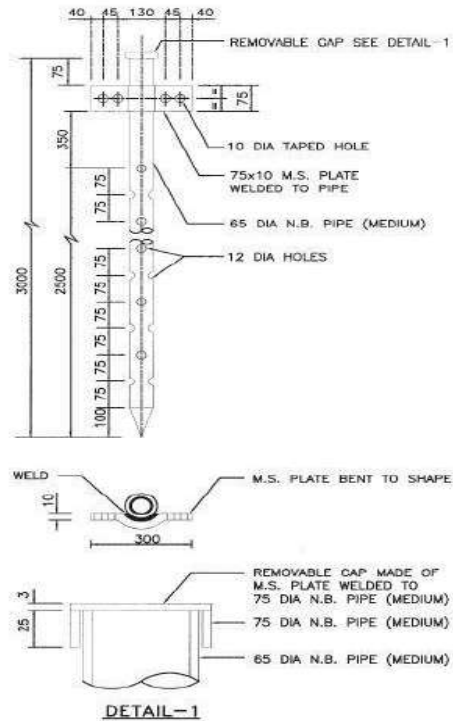
All cables shall be supplied conforming to IEC 60227/ IS 694 & IEC 60502/ IS 1554. Voltage rating: 1,100V AC & 1,500V DC.

- 9.1 For the DC cabling, XLPE or XLPO insulated and sheathed, UV stabilized single core flexible/armored copper cables shall be used. Multi-core cables shall not be used.
- 9.2 Cables used for inter-connecting SPV Modules as well as Modules to DC Combiner & DCDB/SMU shall conform to the requirements. 10 sq.mm size of cable shall be used to minimize the voltage drop.
- 9.3 These cables shall meet the fire resistance requirement and shall be electron beam cured.
- 9.4 For the AC cabling, PVC or XLPE insulated and PVC sheathed single or multicore armored Aluminum/ Copper cables shall be used. Outdoor AC cables shall have a UV stabilized outer sheath.

- 9.5** The total voltage drop on the cable segments from the solar PV modules to the solar grid inverter shall not exceed 1.5%.
- 9.6** The total voltage drop on the cable segments from the solar grid inverter to the building distribution board shall not exceed 1.5%.
- 9.7** The DC cables from the SPV module array shall run through a UV stabilized PVC conduit pipe of adequate diameter with a minimum wall thickness of 1.5mm.
- 9.8** Cables and wires used for the interconnection of solar PV modules shall be provided with solar PV connectors and couplers.
- 9.9** All cables and conduit pipes shall be clamped to the rooftop, walls and ceilings with thermo-plastic clamps at intervals not exceeding 50 cm. In three phase systems, the size of the neutral wire size shall be equal to the size of the phase wires. Insulation of the cable shall have natural colour without any colour additive. The following colour coding shall be used for cable wires:
- a) DC positive: Red (the outer PVC sheath can be black with a red line marking)
 - b) DC negative: Black
 - c) AC single phase: Phase- Red; Neutral- Black
 - d) AC three phase: Phases- Red, Yellow, Blue; Neutral- Black
 - e) Earth wires: Green/Green & Yellow stripes.
- 9.10** Cables and conduits that have to pass through walls or ceilings shall be taken through a PVC pipe sleeve.
- 9.11** Cable conductors shall be terminated with tinned copper end-ferrules to prevent fraying and breaking of individual wire strands. The termination of the DC and AC cables at the Solar Grid Inverter shall be done as per instructions of the manufacturer, which in most cases will include the use of special connectors.
- 10. Junction Boxes**
- 10.1 Junction boxes and solar panel terminal boxes shall be of the Thermo-plastic type with IP 65 protection.
- 10.2 Cable terminations shall be taken through suitable cable glands. Cable ferrules shall be fitted at the cable termination points for identification.
- 11.0 Earthing:**
- 11.1 The PV module structure components shall be electrically interconnected and shall be grounded. Vendor shall construct new earth pits as per the requirement.



- 11.2 Earthing including earth pits shall be done in accordance with IS 3043-1986, provided that earthing conductors shall have a minimum size of 6.0 mm² copper/70 mm² hot dip galvanized steel & earth strip shall be of 25 x 4mm GI strip. The Earth electrode shall be of minimum Class B GI earth electrode of 65mm dia. Unprotected Aluminum or copper-clad Aluminum conductors shall not be used for final underground connections to earth electrodes.
- 11.3 A minimum of two separate dedicated and interconnected earth electrodes must be used for the earthing of the solar PV system support structure with a total earth resistance not exceeding 4 Ohm.
- 11.4 The New Earth pits shall be connected with existing Earthing Network.
- 11.5 Specification for construction of Earth Pit shall be as below
- A. Providing and fixing of new earth electrode with Hot Dip GI pipe and funnel, providing and filling of charcoal, salt and chemical compound of Make Zerolite/Vimco/Bentonite/any other chemical compound suitable for earth pits, construction of earth pit chambers, providing earth pit cover, Painting and numbering of earth pit covers, measurement of earth pit resistance and connecting the earth pit to earth grid/existing earth pit. After excavation broken lumps and stones are to be removed from the earth pit and should be shifted to safe area as specified by EIC.
 - B. The job includes providing hot dip galvanized earth electrode of 65 mm diameter NB class B GI pipe as per below drawing , 12 mm diameter holes are to be drilled on the earth electrode at 75 mm (on alternative sides) intervals for a length of 2.5 meters from bottom portion of the GI electrode for watering purpose. Bottom portion of the GI earth electrode is to be made sharp for easy penetration into the soil. GI Earthing strip of 500 mm (Length) x 10 mm (Thickness) x75 mm (Width) bent to the shape of the pipe and welded at 75 mm from top portion of GI earth electrode. Tapped holes of 10 mm diameter shall be provided on the GI earthing plate for connecting earthing strips to the earth electrode.
 - C. The job includes filling up of the earth pit with high conductivity soil, 50Kg chemical Compound and alternate layers of charcoal or coke dust and common salt (as per drawing) after placing the earth electrode in the excavated earth pit. Charcoal, common salt and high conductivity soil is watered and rammed as tight as possible shall be carried out for proper bonding of the electrode with the adjacent soil. Chamber shall be constructed for earth pit by maintaining the gap of (800mmX800mm) inside the earth pit. Brick masonry work shall be executed with bricks (Class-B) & proper ratio of cement mortar. New MS plate with base frame as per the drawing shall be fixed over the earth pit. MS Plate & base frame to be painted on both sides with one coat of primer (Make: Berger /Asian /Nerolac) and two coats of paint (Make: Berger /Asian /Nerolac). The shade of paint is to be get approved from EIC before startup of painting Job. This job also includes Letter writing on MS cover comprising of EP No_, Pit Value _ Ω, Grid Value_ Ω, done on _, due on _. All dimensions shall be as per the enclosed drawing. All the necessary tools and tackles, material and labour required for completing the above job is in the scope of the contractor. Other technical details are as per Drawing enclosed



NOTE:—

1. THE PIPE ASSEMBLY SHALL BE HOT DIP GALVANISED AFTER FABRICATION.

12.0 Surge Protection:

- 12.1 Surge protection shall be provided on the DC side and the AC side of the solar system.
- 12.2 The DC surge protection devices (SPDs) shall be installed in the DC Distribution box adjacent to the Solar Grid inverter.
- 12.3 The AC SPDs shall be installed in the AC Distribution box adjacent to the Solar Grid Inverter.
- 12.4 The SPDs earthing terminal shall be connected to earth through the above mentioned dedicated earthing system. The SPDs shall be of type 2 as per IEC 60364-5-53.
- 12.5 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 10kA at 8/20 micro second wave as per IEC 61643-12. During earth fault and failure of MOV, the SPD shall safely disconnect the healthy system. SPD shall have thermal 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.

13.0 Lightning Protection System:

- 13.1 Lightning system shall comprise of Air terminations, Down conductors, Test links, Earth electrode etc. as per relevant standards.

13.2 Protection Level solar PV plant should be level – I.

Necessary foundation / anchoring for holding the lightning conductor in position to be made after giving due consideration to shadow on PV array, maximum wind speed and maintenance requirement at site in future.

The vendor shall submit the drawings, calculations and detailed specifications of the PV array lightning protection equipment to Employer for approval before installation of system.

ESE air terminal shall be type tested in any national/international approved lab for advance triggering time (ΔT) and lightning Impulse current test and type test report shall be submitted for approval.

Each ESE air terminal shall be provided with separate earthing termination and test link for equipotential bonding of lightning protection system as per OEM guidelines/NFC 1ESE air terminal shall be equipped with lightning stroke counter to be fixed at suitable height in serial on the down conductor.

The lightning conductor shall be earthed through flats and connected to the grounding mats as per applicable Indian Standards with earth pits. Minimum Two interconnected earth pits shall be provided for each lightning arrester.

Applicable Codes & Standards:

IS 2309: Code of Practice for the protection of building and allied structures against lightning.

NFC 17-102 (Latest revision): Protection from direct lightning stroke with Early Streamer Emission air terminal (ESEAT).

Tools, Tackles and Spares:

The vendor shall provide tools, tackles and essential spares that will be needed for the day-to-day maintenance of the solar PV system. The cost of the same is deemed to be included in the quoted price. This shall include but not be limited to, the following:

- a) Screw driver suitable for the junction boxes and combiner boxes;
- b) Screw driver and / or Allen key suitable for the connectors, power distribution blocks, circuit breaker terminals and surge arrester terminals;
- c) Spanners / box spanners suitable for the removal of solar PV modules from the solar PV module support structure;
- d) Solar panel mounting clamps;
- e) Cleaning tools for the cleaning of the solar PV modules;
- f) Spare fuses
- g) Spare by pass diodes

Caution Signs:

In addition to the standard caution and danger boards/ danger plate or labels as per Indian Electricity Rules & IS 2551, the AC distribution box near the Solar Grid Inverter, the building Distribution board to which the AC output of the solar PV system is connected and the Solar Generation Meter shall be provided with a non-corrosive caution label with the following text:

WARNING – DUAL POWER SOURCE GRID & SOLAR

15.2 The size of the caution label shall be 105mm (width) x 20mm (height) with red coloured letters on a white background.

15.3 The traditional Danger plate as per Indian Electricity Rules & IS 2551 shall also be affixed on Power Conditioning Unit, ACDB & DCDB/SMU.

15.4 Caution labels shall be fixed as per GAIL specifications.

16. Metering:

An Import/ Export Digital Multi-Function Meter along with necessary CT & PT shall be installed in between the Solar Grid Inverter and the AC Distribution board (may be installed in Inverter or ACDB) to measure gross solar AC energy production. The Digital Multi-Function Meter shall have the minimum following specification:

- a) Auxiliary Supply Voltage: 80-270 V.
- b) CT Secondary Current: 1/5A.
- c) PT Secondary: 415V.
- d) Connection: 3 Phase 4 Wire.
- e) Accuracy Class: 0.5
- f) Metering: RMS- V, A, W, VA, VAR, PF, F.
- g) Integral Forward- Wh, VAh, VARh, -VARh, Run Hours, ON Hours.
- h) Integral Reverse- RWh, RVAh, RVARh, -RVARh, Run Hours.
- i) Burden: $\leq 0.2VA$ per phase.
- j) Communication: RS485.
- k) Mounting: Flush.
- l) Size: 96mm x 96mm or 72mm x 72mm.
- m) Direct reading of primary values- No multiplication factor.

- n) Kilo, Mega, and Giga indications with auto scaling capability.
- o) User selectable default display page and lock.
- p) LED Indication for checking the presence of input supply voltage.

17.Submittals along with Technical Bid:

The bidder shall submit the following documents for technical evaluation:

- i) Datasheet & Catalogue of Solar PV module under Standard Test Conditions (STC) and Nominal Operating Cell Temperature (NOCT).
- ii) I-V & P-V characteristic of the PV modules.
- iii) Type Test reports of Solar cell.
- iv) Electro Luminescence (EL) test report of PV modules.
- v) Datasheet & Catalogue of Solar Charge Controller (MPPT).
- vi) Datasheet & Catalogue of Power Conditioning Unit/ Solar Inverter.
- vii) Datasheet & Catalogue of Surge Protection Device (SPD).
- viii) Datasheet & Catalogue of Import/Export type Digital Multi- Function Meter.

18.0 Submittals before supply of Materials:

Entire drawings, detailed test & flash reports and compliance certificates, Electro Luminescence (EL) test reports of all the offered modules, Design and calculations report of the PV module mounting structure, Electrical scheme drawing of the PCU/Inverter, Electrical Scheme drawing of the whole system, Type test reports of all the equipments, GA drawing of the PV array etc. should be submitted for approval of EIC before supply of materials and supply should start thereafter

19.0 Documentation:

The vendor shall supply the following documents in 02 (two) hard copies & 01(one) soft copy after completion of execution:

- a) System Description with working principles.
- b) System Single Line Diagram (SLD).
- c) Solar PV array lay-out.

- d) Routing diagram of cables and wires.
- e) Data sheets and user manuals of the Solar PV Panels, Solar Grid Inverter, MPPT Charge Controller along with necessary software, Surge protection devices etc.
- f) A system Operation and Maintenance manual.
- g) Name, address, mobile number and email address of the service centre to be contacted in case of failure or complaint.
- h) Warranty cards.

Maintenance register.

20.0 Tests to be Carried out:

Factory Acceptance Tests are to be carried out in presence of representative of GAIL. Advance intimation (at least 15 days before) shall be given to GAIL for witnessing the factory acceptance tests at manufacturer's/ vendor's premises. Vendor shall submit the QAP in advance for approval of GAIL before carrying out the tests. All the Type Tests, Routine Tests & Factory acceptance shall be carried out as per relevant IS/IEC/IEEE/Any other standards & specifications.

Tests e.g. EL test of Solar PV module, Performance test at Standard Test Conditions of Solar PV cells/ modules, IR-HV-IR test (as per IS 2500 Part 1) of DCDB/SMU, String Monitoring Card/ Power Supply card/ DC-DC Converter function check (as per IS 2500 Part 1), Test to demonstrate automatic / manual synchronization and connection to utility service of the PCU, Test to demonstrate operation protective (including utility service interface protection) and instrumentation circuits demonstrated by direct test if feasible or by simulation operation conditions for all parameters that cannot be directly tested, Test to demonstrate operation of start-up, stable operation of the PCU, disconnection and shutdown controls and response to other control signals, Sample testing to include measurement of phase currents, efficiencies, harmonic content and power factor at four points preferably 25, 50, 75 and 100% of the rated nominal power, Maximum power point tracking (MPPT) functional check etc. are minimum to be carried out. Apart from the above tests all other tests required as per relevant IS/IEC/IEEE/Any other standards & specifications shall also to be carried out.

After installation of the whole Solar PV system at site, performance test of the whole system is to be carried out by the vendor at site.

21.0 Test Certificates and Reports to be Furnished:

Test Certificates from NABL accredited laboratory for relevant IEC / equivalent BIS standard for quoted components shall be furnished. Type Test Certificates shall be provided for the solar modules and the solar grid inverters to provide evidence of compliance with standards as specified in the Technical Specification. Routine & factory acceptance test reports are also

required to be submitted along with the supplied material. GAIL reserves the right to ask for additional test certificates or (random) tests to establish compliance with the specified standards

22.0 Training:

The vendor should provide onsite/ offsite training to at least 04 (four) nos. of GAIL Employees about the complete Solar PV system. Lodging & Boarding charges of GAIL employees will be borne by GAIL.

23.0 BIDDER’S CHECKLIST

Vendor must mark "Yes" (for acceptance) or "No"(for non-acceptance) in the "vendor acceptance" column of the following checklists. Additionally vendor must fill the data where “vendor to specify” is mentioned in the following checklist.

All the specifications/points must necessarily be filled in. Any point left out is deemed as not accepted without any reason thereof.

Relevant complete technical literature has to be enclosed for every offered model.

For any contradictory points in the specifications and scope of supply, vendor shall refer to GAIL for clarification before submitting the offer.

a) Solar PV Module:

		Vendor Acceptance/ Comment 25 Kw for all Locations
Make	Vendor to specify	
Model	Vendor to specify	
Origin	Manufactured in India	
Catalogue	Vendor to submit Catalogue & Specification sheet for Technical Evaluation	
Type	Crystalline silicon	
Number of Cells	Minimum 60	
Electrical Parameters at Standard Test Conditions (STC)		

Nominal Power output	≥250 Wp	
Power Tolerance	0 ~ +5 W	
Module Efficiency	≥15%	
Voltage at P _{MAX} (VMPP)	Vendor to specify	
Current at P _{MAX} (IMPP)	Vendor to specify	
Open Circuit Voltage, VOC	Vendor to specify	
Short Circuit Current, ISC	Vendor to specify	
Electrical Parameters at NOCT		
NOCT (OC)	47 ± 2	
Power output, P _{MAX}	Vendor to specify	
Voltage at P _{MAX} , VMPP	Vendor to specify	
Current at P _{MAX} , IMPP	Vendor to specify	

Open Circuit Voltage, VOC	Vendor to specify	
Short Circuit Current, ISC	Vendor to specify	
Temperature co-efficient of Current, ISC (%/OC)	Vendor to specify	
Temperature co-efficient of Voltage, VOC (%/OC)	Vendor to specify	
Temperature co-efficient of Power, P _{MAX} (%/OC)	≤ - 0.45	
Maximum System Voltage (V)	Vendor to specify	
Maximum series fuse rating (A)	Vendor to specify	
Limiting reverse current (A)	Vendor to specify	
Fill Factor	≥72%	
Operating Temperature Range (°C)	-10 to +85 °C	
Identification Tag	Required	
PID Free modules	Required	
Module frame material	Anodized Aluminium	
Maximum Static Load	Vendor to specify	
Module Dimension L x W x H	Vendor to specify	
Module weight	Vendor to specify	
Glass	Thickness ≥2.5mm, Toughened	

Transmittance of the Glass	≥90%	
Junction Box	Minimum IP 65 rated	
Warranty	10 years against all material/ manufacturing defects and workmanship Panel output (Wp) capacity to be ≥90% of design nominal	
Degradation warranty	power after 10 years and ≥80% of design nominal power after 25 years.	
Product Certification	IEC Certification Required	
EL inspection & test certificate	Required	

b) Power Conditioning Unit/ Solar Grid Inverter:

Description	Requirement	Vendor Acceptance/ Comment 25 Kw for all Locations
Make	Schneider/ABB/Siemens	
Model	Vendor to specify	
Catalogue	Vendor to submit Catalogue & Specification sheet for Technical Evaluation	
Output power	Minimum 25 kW	
Input DC voltage range	As required for the Solar Grid inverter DC input	

Operating AC voltage	Three phase 415V (+ 15%, - 20%) as per design requirement
Operating Frequency range	47.5 – 52.5 Hz
Nominal Frequency	50 Hz
Inverter efficiency	≥95%
Inverterweighted efficiency	≥94%
Power Factor	≥0.98 at nominal power
Total Harmonic Distortion	3% for Voltage
	5% for Current
Built-in Protection	<ul style="list-style-type: none"> a) Over current b) Sync loss c) Over temperature d) AC/ DC bus over voltage e) Cooling Fan failure (If provided) f) Short circuit g) Lightning h) Earth fault i) Surge voltage induced at output due to external source j) Power regulation in the event of thermal overloading

	Integrated protection in the DC and three phase system	
Charge controller	MPPT Charger controller	
Anti-Islanding protection	Required	
Degree of Protection	Minimum IP 65 for outdoor mounting, IP 42 for indoor mounting	
Communication interface	RS 485 / RS 232 / RJ45	
Display type	LCD/LED for data display. LCD / LED for status display	
Operating ambient temperature range	00 C to +500 C	
Humidity	0 – 95% Rh	
Cooling	Convection/ Forced Air cooling	
Flicker	As per IEC 61000	
Maximum noise level	75 dBA	

c) **Energy Meter**

		Vendor Acceptance/ Comment
--	--	-----------------------------------

Description	Requirement	25 Kw for all Locations
Make	Vendor to specify	
Model	Vendor to specify	
Catalogue	Vendor to submit Catalogue & Specification sheet for Technical Evaluation	
Auxiliary Supply Voltage	80-270 V	
CT Secondary Current	User selectable	
PT Secondary	User selectable	
Connection	3 Phase 4 Wire	
Accuracy Class	0.5	
Metering	RMS- V, A, W, VA, VAR, PF, F Integral Forward- Wh, VAh, VARh, -VARh, Run Hours, ON Hours Integral Reverse- RWh, RVAh, RVARh, -RVARh, Run Hours	
Burden	<=0.2VA per phase	
Communication	RS485	

Mounting	Flush	
Size	96mm x 96mm or 72mm x72mm	
Auto scaling	Required	

SECTION VII
SCHEDULE OF RATES