BHUTAN POWER CORPORATION LIMITED

(An ISO 9001:2015, ISO 14001:2015&OHSAS 18001:2007 Certified Company)

Distribution Construction Department
Renewable Energy Division
Thimphu: Bhutan

Bidding Document

For

Supply, Install, Testing and Commissioning of 180kW Grid-Tied Ground-Mounted Solar Power Project at Rubessa under Wangdue Phodrang District, Bhutan

Identification No. 08/BPC/RED/DCD/2020/Vol-1/46 Dt.07/09/2020

September 2020

BHUTAN POWER CORPORATION LIMITED

(*An ISO 9001:2015, ISO 14001:2015 & OHSAS 18001:2007 Certified Company*)

Distribution Construction Department
Renewable Energy Division
Thimphu: Bhutan

Bidding Document

For

Supply, Install, Testing and Commissioning of 180kW Grid-tied ground mounted Solar Power Project at Rubessa under WangduePhodrang district, Bhutan

Tender No. 08/BPC/RED/DCD/2020/Vol-I/46 Dt. 07/09/2020

Volume I Part-1 – Terms and Condition

September 2020

Bhutan Power Corporation Limited
(Registered Office, Thimphu)
(An ISO 9001:2015, ISO 14001:2015 & OHSAS 18001:2007 Certified Company)
Renewable Energy Division
Distribution Construction Department
Thimphu: Bhutan

08/BPC/RED/DCD/2020/Vol-I/46 September 7, 2020

NOTICE INVITING TENDER (NIT)

The Renewable Energy Division (RED), Distribution Construction Department (DCD), Bhutan Power Corporation Limited (BPC) is pleased to invite bid (Single Stage Single Envelope System – Technical Bid & Financial Bid under Single Envelop) from eligible bidders for the work ***"Supply, Installation, Testing and Commissioning of 180kW Grid-tied ground mounted Solar Power Project at Rubessa under WangduePhodrang district, Bhutan".*** The Eligibility Criteria are mentioned in the bidding document.

1. The soft copy of the complete set of Bidding Documents can be downloaded from BPC's website at www.bpc.bt/category/tender from **07/09/2020 to 07/10/2020** by the Bidder(s) or their representatives. Those who have downloaded & printed the bidding document should register with RED, BPC with on or before the closing of the bid sale date with application via email and upon payment of Nu. 200 (Ngultrum two hundred only) to make the bid enforceable.

2. BPC shall not be responsible for loss of documents or delay in dispatch through post. Further, the issuance of documents shall not construe automatic qualification of Bidders.

3. The bids shall be submitted via email with password protected to this email addresses **pema_wangchuk@bpc.bt**; drukchudorji@bpc.bt . However, the issuance of documents shall not construe automatic qualification of Bidders.

4. All bids must be accompanied by Earnest Money/Bid Security of Nu. **365,000.00** (Ngultrum Three Hundred Sixty-Five Thousand) in the form of electronic Demand Draft or Bank Guarantee that are being issued at the current situation by the banks and it should be valid at least up to 04/01/2021. For the purpose of determining the equivalent amount of the required Bid Security in a freely convertible currency, the exchange rates published by Royal Monetary Authority of Bhutan (RMA) prevailing on the date 28 days prior to the deadline for bid submission shall be applied.

5. Before submission of the bid, bidders are required to make themselves fully conversant with the completeness of bid specifications.

6. Bids complete in all respects may be submitted via email to the address given below before 13:00 hours on 07/10/2020 and the bids shall be opened on the same day at 14:30 Hrs. online.

7. BPC reserves the right to cancel/withdraw/reject the bidding process without assigning any reason and shall bear no liability whatsoever consequent upon such a decision

8. The Employer shall not be responsible for any costs or expenses incurred by bidders in connection with the preparation or delivery of bids and/or clarification meeting.

(Manager)
Renewable Energy Division

Section 1A – Instruction to Bidders (ITB)

SECTION 1A

INSTRUCTION TO BIDDERS (ITB)

TABLE OF CLAUSES

F. AWARD OF CONTRACT

G. BID DATA SHEET (BDS)

SECTION 1A - INSTRUCTIONS TO BIDDERS

A. GENERAL

1. **Scope of Bid**

1.1 Renewable Energy Division (RED) under Distribution Construction Department, Bhutan Power Corporation Limited (BPC), Bhutan (hereinafter referred to as the Employer), invites bid (**Single Stage Single Envelope System – Technical Bid & Financial Bid under Single Envelope)** for the Supply, Installation, Testing & Commissioning of 180kW Grid-Connected Ground-Mounted Solar PV Plant 180kW at Rubessa, Wangduephodrang involving:

a. Supply and delivery of the materials as per the technical specifications.

b. Handling, Storage, Installation, Testing and commissioning of the equipments to complete works in all respects and in accordance to the design and engineering submitted by the Employer.

c. Civil works involving site development and foundation works for equipment mounting structure and accessories, cable laying, drainage, fencing, transformer footing, etc as described in the technical specifications of civil works.

d. Any other works that are required to complete the project in all respects and to generate a desired output/electricity.

1.2 Bidders shall adhere to all the statutory regulations of Royal Government of Bhutan while undertaking the works.

1.3 The Successful bidder will be expected to complete the Works within 5 (Five) months from the date of handing over of the site, as defined in the Conditions of Contract.

2. **Eligible Bidders**

2.1 This Notice Inviting Tender is under international Competitive Bidding and open to registered and eligible large contractors, who fulfill the Qualification Requirements given in Clause 4 and meet the following requirements:

A bidder (including all members of a Joint Venture and all sub-contractors of a bidder) shall not be affiliated with a firm or entity

a) Which has provided consulting services to the Employer during the preparatory stages of the Works or of the project of which the Works form a part, or

b) Which has been hired (or is proposed to be hired) by the Employer as Engineer for the Contract.

2.2 Bidders shall provide such evidence of their eligibility satisfactory to the Employer as the Employer shall reasonably request.

3. **Origin of Materials, Equipment And Services**

3.1 The Origin of Materials, Equipment and Services to be supplied for this Project shall be from sources which do not contravene the statutory requirements of Royal Government of Bhutan.

"Origin" means the place where the materials and equipment are mined, grown, produced or manufactured, and from which the services are provided. Materials and equipment are produced when, through manufacturing, processing or substantial or major assembling of components, a commercially recognized product results that is substantially different in basic characteristics or in purpose or utility from its components.

4. **Qualification of the Bidder**

4.1 To be qualified for award of Contract, bidders shall:

a) submit a written power of attorney authorizing the signatory of the bid to commit the bidder; and

b) submit satisfactory evidence concerning the following:

i) The bidder is a qualified manufacturer/ erector/ or an authorized representative of a qualified manufacturer/ erector who regularly manufactures/erects the equipment/ materials of the type quoted and has adequate technical knowledge and practical experience.

ii) The bidder does not anticipate change in ownership during the proposed period of work (if such a change is anticipated, the scope and effect thereof shall be defined).

iii) The bidder has adequate financial capability to meet the financial obligations pursuant to the

scope of the works. The bidder shall submit two (2) copies of profit and loss account for the past three (3) years.

iv) Bhutanese bidders, who wish to participate in the tender as a partner of any Joint Venture, shall furnish a copy of the Valid Business License, Construction Development Board (CDB) registration certificate and Tax Clearance Certificate (TCC) issued by component competent authorities. With regard to submission of Tax Clearance Certificate, this clause is equally applicable to other tax paying non-Bhutanese firms working in Bhutan.

v) The bidder has access to adequate equipment and capacity to execute the works within the time specified. The evidence shall consist of written details of the installed manufacturing capacities and present commitments (excluding the work under this specification) of the bidder or his principal. If the present commitments are such that the installed capacity results in inadequacy of the manufacturing capacity to meet the requirement of equipment/ materials corresponding to this tender, then the details of alternative arrangements made shall also be furnished.

vi) The bidder has adequate field service organization to provide the necessary field erection and management services required to successfully supply, install, test and commission, the equipment/ materials as required under the specifications.

vii) The bidder has established Quality Assurance System and Design Organization to achieve high level of equipment/ material reliability during manufacture and installation.

viii) The bidder should provide details of any current litigation that he is involved with.

4.2 Bids submitted by a Joint Venture of two or more firms as partners shall comply with the following requirements:

a) the bid, and in case of a successful bid, the Form of Agreement, shall be signed so as to be legally binding on all partners;

b) one of the partners shall be authorized to be in charge (referred as Lead Partner or Partner-In-Charge); and this authorization shall be evidenced by submitting a power of attorney signed by legally authorized signatories of all the partners;

c) the Partner-In-Charge/Lead Partner shall meet all the Technical Qualification Requirements by itself and each of the other partners shall meet at least 25% of the technical or financial qualification requirements;

c) The Partner-In-Charge shall be authorized to incur liabilities and receive instructions for and on behalf of any or all partners of the joint venture and the entire execution of the Contract including payment shall be done exclusively with the partner-in-charge. The partner-in-charge cannot transfer his responsibility / authority to any other partners during the currency of the contract;

e) all partners of the joint venture shall be jointly and severally liable for the execution of the Contract in accordance with the Contract terms, and a relevant statement to this effect shall be included in the authorization mentioned under (b) above as well as in the Bid Form and the Form of Agreement (in case of successful bid); and

f) A copy of the agreement entered into by the joint venture partners shall be submitted with the bid.

4.3 Bidders shall also submit proposals of work methods and schedule, in sufficient detail to demonstrate the adequacy of the bidders' proposals to meet the technical specifications and the completion time referred to in Sub-Clause 1.3 above.

4.4 Qualification will also be based on meeting all the following minimum criteria regarding the Bidder's general and particular experience, personnel and equipment capabilities and financial position as demonstrated by the Bidder's responses in the corresponding schedules to the Bid.

The Employer reserves the right to waive minor deviations if they do not materially affect the

capability of a Bidder to perform the Contract.

4.5 Experience of the Contractor/ Bidder

The bids of only those bidders, who meet the following minimum qualification criteria will be considered for further evaluation:

(a) Technical Qualification Requirements

Supplied, installed, tested and commissioned at least two (2) numbers of Grid connected Solar Power Plant of similar capacity or above including civil works, MV and LV cable laying. The above work should have been in operational for a minimum period of three (3) years as on the date of bid opening. The bidder shall furnish along with the bid, documentary evidence like project completion and performance certificates, etc. from their clients as a proof of their competencies. The bidder should have adequate personnel (electrical and civil engineer) in their pay roll.

(b) Financial Qualification Requirements

i) The Bidder should have an Average Annual Turnover (defined as billing for works in progress and completed) over last three(3) years of Nu. 36.00 Million (Ngultrum Ten Million Only).

ii) The Bidder should also demonstrate that he has access to, or available, liquid assets unencumbered real assets, line of credit and other financial means (inter alia including a Guarantee or an undertaking from a Bank or Financier) sufficient to meet the construction cash flow for a period of two months, estimated at Nu. 6.0 million (Ngultrum Six Million Only) or equivalent, net of the Bidder's commitments for other contracts.

The audited balance sheets for the last five years should be submitted and must demonstrate the soundness of the Bidder's position, showing long

term profitability. Where necessary the Employer will make inquiries with the Bidder's bankers.

The Bidder shall fill the above information in Schedules given in the bid document.

4.6 Qualification of Associate Contractors/ Manufacturer's

The bidder may propose to any manufacturer/ vendors for approved makes as specified in the Technical Specifications and the Employer may approve these proposed vendors/ manufacturers subjected to factory assessment, if required. However, the Employer reserves the right to insist on the Contractor to supply through any Approved Makes of the Employer. The Employer may approve alternate supplier in case of closure/ merger of the specified make.

5 **One Bid per Bidder**

5.1 Each bidder shall submit only one bid either by itself, or as a partner in a joint venture or as a responsible officer in the management of the company. A bidder who submits or participates in more than one bid other than alternatives pursuant to Sub-Clause 17.1 will be disqualified.

6. **Cost of Bidding**

6.1 The bidder shall bear all costs associated with the preparation and submission of its bid and the Employer will in no case be responsible or liable for those costs.
The cost of the bidding document shall be as specified in the BDS.

7. **Site Visit**

7.1 The bidder may opt to visit and examine the Site of Works and its surroundings and obtain for itself on its own responsibility all information that may be necessary for preparing the bid and entering into a contract for the Works. The costs of visiting the Site shall be at the bidder's own expense and at his own risk.

7.2 The bidder and any of its personnel or agents will be granted the clearance and permission by the Employer to enter its premises and lands for the purpose of such inspection, but only upon the express condition that the bidder, its personnel and agents, will release and indemnify the Employer and its personnel and agents from and against all liability in respect thereof and will be responsible for death or personal injury, loss of or damage to

property and any other loss, damage, costs and expenses incurred as a result of the inspection.

7.3 The Employer may conduct a Site visit concurrently with the Pre-Bid Meeting referred to in Clause 18.

(This clause is Not applicable for this bid)

B. BIDDING DOCUMENTS

8. **Content of Bidding Documents**

8.1 The bidding documents are those stated below, and should be read in conjunction with any Addenda issued in accordance with Clause 10.

VOLUME I

Part- I

1A Notice Inviting Tender (NIT)
1B Instructions to Bidders (ITB)
General Conditions of Contract (GCC)
(FIDIC – E & M Works Third Edition 1987) Reprinted with further amendments in 1992.
1C Preamble
Special Conditions of Contract (SCC)

Part- 2

2A General Technical Requirements (GTR)
2B Technical Specification
2C Installation, testing and commissioning
2D Drawings, test certificates and O&M manuals
2E Contractor's safety program

VOLUME II

Part – 1

Guaranteed Technical Particulars
Forms:
Forms and Technical information,
Forms of Bid and Bid Security,
Form of Agreement,
Forms of Performance Bank Guarantee and Bank Guarantee for Advance Payment.
Form of Deviations from and exception to Bid Document
Form of Contractor's Key Personnel and Implementation Methodology
Form of Bidder's Experience
Form of current contract commitments/works in progress
Form of Bidder's Annual Turnover
Form of Credits, Loans and Overdraft Facilities
Proposed Site Organization Management
Sub-contracting of Specialized Work
Form of Contractor's Declaration
Integrity Pact

Part - 2
Schedule of Prices (including Bill of Quantities)

The bidder is expected to examine carefully the contents of the Bidding documents. Failure to comply with the requirements of bid submission will be at the bidder's own risk.

Pursuant to Clause 28, bids which are not substantially responsive to the requirements of the bidding documents will be rejected.

9. **Clarification Of Bidding Documents**

9.1 A prospective bidder requiring any clarification of the bidding documents may notify the Employer in writing or by facsimile at the Employer's address indicated in the Notice Inviting Tender (NIT). The Employer will respond to any request for clarification, which it receives earlier than 14 days prior to the deadline for submission of bids. Copies of the Employer's response will be forwarded to all purchasers of the bidding documents, including a description of the enquiry.

10. **Amendment of Bidding Documents**

10.1 At any time prior to the deadline for submission of bids, the Employer may, for any reason, whether at its own initiative or in response to a clarification requested by a prospective bidder, or based on the proceedings of the pre-bid conference modify the bidding documents by issuing addendum.

10.2 Any addendum thus issued shall be part of the bidding documents pursuant to Sub-Clause 8.1, and shall be communicated by the Employer in writing or by facsimile or by mail to all purchasers of the bidding documents. Prospective bidders shall acknowledge receipt of each addendum to the Employer.

10.3 To afford prospective bidders reasonable time in which to take an addendum into account in preparing their bids, the Employer may extend the deadline for submission of bids, in accordance with Clause 21.

C. PREPARATION OF BIDS

11. **Language of Bid**

11.1 The bid, and all correspondence and documents, related to the bid, exchanged between the bidder and the Employer shall be written in the English language. Supporting documents and printed literature furnished by the bidder may be in another language provided they are accompanied by an accurate translation of the relevant passages in the English language, in which case, for purposes of interpretation of the bid, the English translation shall prevail.

12. **Documents Comprising The Bid**

12.1 The bidder shall submit bids in one envelope containing both price and technical bid and will be opened in public at the date and time advised in the bidding document.

12.2 The bid shall comprise of the following:

Bid security, Integrity Pact, Technical Bid Form, Appendix to Bid, the information on eligibility and qualification, schedules of supplementary information, including those for alternatives, where proposed by the bidder and any other materials required to be completed and submitted by Bidders in accordance with these Instructions to Bidders. The documents listed under Part 1 of Volume II (Bid Security and Integrity Pact shall be in the format provided. The Technical Bid Form and Appendix to Bid shall be without any price information) and Guaranteed Technical Particulars pursuant to Part 1 of Volume 2 shall be filled in without exception, subject to extensions thereof in the same format and to the provisions of Sub-Clause 16.2 regarding the alternative forms of Bid Security.

The Guaranteed Technical Particulars, where sought for, shall also be submitted in a soft copy (CD). However, the contents of the hard copy shall govern for the purpose of evaluation.

Price Bid Form and Appendix to Bid including other information pursuant to clause 13.5, priced Bill of Quantities,

The filled up price schedule shall also be submitted in soft copy (CD). However, the contents of the hard copy shall govern for the purpose of evaluation.

13. **Bid Prices**

13.1 Unless stated otherwise in the Bidding documents, the Contract shall be for the whole Works as described in Sub-Clause 1.1, based on the schedule of unit rates and prices submitted by the bidder.

13.2 a) The Bidder must quote unit Free at Site (FAS) prices of all items (along with Ex-works prices) for delivery of items to the actual site of installation including any storage, carriage (during transit and at site) by head load (if any) charges etc. as may be necessary. The unit FAS price shall comprise of the following components:

Ex-works price, packing and forwarding charges, railway freight, transport charges to actual work site, storage as and where necessary, charges for transit insurance against all risks and storage after receipt of equipment at destination stores, all taxes, duties and levies. Insurance of materials/ equipment/ goods at site is a mandatory requirement of the Royal Government of Bhutan.

13.3 The bidder shall fill in rates and prices for all items of the Works described in the Bill of Quantities. Items against which no rate or price is entered by the bidder will not be paid for by the Employer when executed and shall be deemed covered by the other rates and prices in the Bill of Quantities.

13.4 All duties, taxes and other levies payable by the Contractor in Bhutan under the Contract, or any other clause, as of the date 28 days prior to the deadline for submission of bids shall be included in the rates and prices and the total bid price submitted by the bidder, and the evaluation and comparison of bids by the Employer shall be made accordingly. It is the responsibility of the Bidder to ascertain the value of applicable tax rates (Bhutan Sales Tax and / or Customs Duty and or any other applicable taxes / duties) for various items under Price Schedule and indicate the same in the price schedules. It shall be noted that payment towards such taxes / duties in Bhutan, will be limited to the value obtained by using the rate quoted in the Bid, unless there is any change in rates notified by relevant authorities after the date 28 days prior to the submission of Bids. In the event of such change by relevant authorities, the differential amount (increase or decrease) will be based on the differential rates between revised

notified value and the maximum of (i) the rates assumed by the Bidder in its offer and (ii) the actual rate prevalent at the time 28 days prior to the due date of bid submission.

13.5 The rates and prices quoted by the bidder shall not be subject to adjustment during the performance of the Contract in accordance with Clause 31 of the Conditions of Contract.

14. **Currency of Bid and Payment**

14.1 The unit rates and the prices shall be quoted by the bidder either in Bhutanese Ngultrum/Indian Rupees or in US Dollars (for third country supplies) for the relevant items. Bidders may note that no payment to Indian or Bhutanese Contractors can be released in currencies other than Indian Rupees or Bhutanese Ngultrum. For items with price quoted in US Dollars (for third country supplies), the equivalent Bhutanese Ngultrum payment would be made based on the exchange rate (at Bills Selling Rates of Exchange published by the Royal Monetary Authority of Bhutan) on the date of release of such payment. Bhutanese Ngultrum and Indian Rupees is at par.

15. **Bid Validity**

15.1 Bid shall remain valid for the period as specified in the BDS after the date of bid opening specified in Clause 24.

15.2 In exceptional circumstances, prior to expiry of the original bid validity period, the Employer may request that the bidders to extend the period of validity for a specified additional period. The request and the responses thereto shall be made in writing or by facsimile or by mail. A bidder may refuse the request without forfeiting its bid security. A bidder agreeing to the request will not be required or permitted to modify its bid, but will be required to extend the validity of its bid security for the period of the extension, and in compliance with Clause 16 in all respects.

16. **Bid Security**

16.1 The bidder shall furnish, as part of its bid, a bid security in original form and in the amount and currency specified in the BDS.

16.2 The Bid Security shall, at the bidder's option, be in the form of a banker's certified cheque, cash warrant, standby letter of credit or bank guarantee from a reputable financial institution in Bhutan or counter guaranteed and by a reputable financial institution in Bhutan and should be enforceable and en-cashable in Bhutan. The bid security shall be

drawn in favor of **"Director, Finance & Account Services, Bhutan Power Corporation Limited, Thimphu, Bhutan"** payable at Bank of Bhutan, Thimphu, Bhutan. The format of the bank guarantee shall be in accordance with the sample form of Bid Security included in Part I in Volume 2. Letters of credit and bank guarantees issued, as surety for the bid shall be valid for 28 days beyond the validity of the bid validity.

Bid Security, provided by the bidder shall be from a Bank/Financial Institution in Bhutan/directly by a foreign bank acceptable to the Employer.

All the Bank Guarantees or securities/sureties associated with this tender like Bid Security, Performance Security, etc. provided by the Bidder shall be either from a Bank/Financial Institution in Bhutan or a Bank/Financial institution outside Bhutan with a correspondent Financial Institution located in Bhutan to make these enforceable or by a foreign bank acceptable to the Employer. It is the Bidders responsibility to ensure that Bank Guarantees issued by a Bank/Financial Institution outside Bhutan are unconditionally encashable or enforceable at Banks/Financial Institution in Bhutan. This is a prerequisite for the Bid to be considered responsive. Bid not conforming to this requirement shall be treated as non-responsive resulting in outright rejection of the Bid.

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

16.4 The bid securities of unsuccessful bidders shall be returned after signing of the Contract, in any case not later than the expiration of the period of bid security validity.

16.5 The bid security of the successful bidder will be returned upon furnishing required performance security and signing of the Contract by bidder.

16.6 The bid security may be forfeited

(a) if the bidder withdraws its bid during the period of bid validity; or

(b) if the bidder does not accept the correction of its bid price, pursuant to Sub-Clause 29.2; or

(c) in the case of a successful bidder, if he fails

within the specified time limit to

(i) Sign the Agreement, or
(ii) Furnish the required performance security.

17. **Alternative Proposals by Bidders** (Not Applicable for this Bid)

17.1 Bidders wishing to offer technical alternatives to the requirements of the bidding documents must first price the Employer's design as described in the bidding documents and shall further provide all information necessary for a complete evaluation of the alternative by the Employer, including drawings, design calculations, technical specifications, breakdown of prices, and proposed construction methods. Only the technical alternatives, if any, of the lowest evaluated bidder conforming to the basic technical requirements shall be considered by the Employer for adoption, at the sole discretion of the Employer.
(This clause is not applicable for this bid)

18. **Pre- Bid Meeting**

18.1 The bidder or its official representative is invited to attend online pre-bid meeting in accordance with BDS pursuant or as any other dates as amended. Due to the COVID-19 situation the site visits by the contractor and a joint site visit may not be applicable. However, bidders are advised to use google earth and google maps to get all the information about the site.

18.2 The purpose of the meeting will be to clarify issues and to answer questions on any matter that may be raised at that stage.

18.3 The bidder is requested to submit any questions in writing or by fax, to reach the Employer not later than one week before the pre-bid meeting.

18.4 Proceedings of the meeting, including the text of the questions raised and the responses given, will be transmitted without delay to all purchasers of the bidding documents. Any modification of the bidding documents listed in Sub-Clause 8.1 which may become necessary as a result of the pre-bid meeting shall be made by the Employer exclusively through the issue of an Addendum pursuant to Clause 10 and not through the minutes of the pre-bid meeting.

18.5 Bidders are advised to attend the pre-bid meeting. However, non-attendance at the pre-bid meeting will not be a cause for disqualification of a bidder.

18.6 All costs associated with attending the pre-bid meeting and / or site visits shall be borne by the Bidder. It shall be noted that the Employer's undertaking, to arrange for the necessary permits for the pre-bid meeting / site visit shall not be construed as Employer's commitment to provide the same, especially in the absence of any statutory requirements not being met by the Bidder.

19. **Format and Signing of Bid**

19.1 The bidder shall prepare ONE original and ONE copy of the Bid documents comprising the bid as described in Clause 12 of these Instructions to Bidders, bound with the volume containing the Forms of Bid, and clearly marked "ORIGINAL" and "COPY" as appropriate, on the bids. In the event of any discrepancy between them, the original shall prevail.
(This clause is not applicable for this bid since the bid shall be submitted by email with password protected)

19.2 The original and all copies of the Technical and Price bids shall be typed or written in indelible ink (in the case of copies, Photostats are also acceptable) and shall be signed by a person or persons duly authorized to sign on behalf of the bidder, pursuant to Sub-Clause 4.1 (a) or 4.2 (b), as the case may be. All pages of the bid where entries or amendments have been made shall be initialed by the person or persons signing the bid.

19.3 The Technical and Price bids shall contain no alterations, omission or additions, except those to comply with instructions issued by the Employer, or as necessary to correct errors made by the bidder, in which case such corrections shall be initialed by the person or persons signing the bid.

19.4 The Power of Attorney signed by legally authorized Signatories of the firm/company authorizing the bidder's official to sign the bid shall be submitted without which the bid shall be treated as non-responsive and shall be rejected.

D. SUBMISSION OF BIDS

20. **Sealing and Marking of Bids**

20.1 The bidder shall seal the original and each copy of the bid in an inner and an outer envelope, duly marking the envelopes as "BID - ORIGINAL" and "BID - COPY".
(This clause is not applicable since the bid shall be submitted by email with password protected)

20.2 The inner and outer envelopes shall:
(a) bear the name and address of the Bidder,
(b) be addressed to the Employer in accordance with BDS.
(c) bear the specific identification of this bidding process indicated in the BDS.

20.3 In addition to the identification required in Sub-Clause 20.3, the inner envelope shall indicate the name and address of the bidder to enable the bid to be returned unopened in case it is declared "late" pursuant to Clause 22.

20.4 If the outer envelope is not sealed and marked as above, the Employer will assume no responsibility for the misplacement or premature opening of the bid.

21. **Deadline for Submission of Bids**

21.1 Bids must be received by the Employer at the address and no later than the date and **time** indicated in the BDS.

21.2 The Employer may, at his discretion, extend the deadline for submission of bids by issuing an addendum in accordance with Clause 10 in which case all rights and obligations of the Employer and the bidders previously subject to the original deadline will thereafter be subject to the deadline as extended.

22. **Late Bids**

22.1 Any bid received by the Employer after the deadline for submission of bids prescribed in Clause 21 will be declared late, rejected and returned unopened to the bidder.

23. **Modification and Withdrawal of Bids**

23.1 The bidder may modify or withdraw its bid after bid submission, provided that written notice of the modification or withdrawal is received by the Employer prior to the deadline for submission of bids.

23.2 The bidder's modification or withdrawal notice shall be prepared, sealed, marked and delivered in accordance with the provisions of Clause 20, with the outer and inner envelopes additionally marked "MODIFICATION" or "WITHDRAWAL", as appropriate. A withdrawal notice may also be sent by fax but must be followed by a signed confirmation copy.

23.3 No bid may be modified/withdrawn by the bidder after the deadline for submission of bids.

23.4 Withdrawal of a bid during the interval between the deadline for submission of bids and the expiration of the period of bid validity specified in the Form of Bid may result in the forfeiture of the bid security pursuant to Clause 16.

E. BID OPENING AND EVALUATION

24. **Bid Opening**

24.1 The Employer will open the bids, including modifications made pursuant to Clause 23, in the presence of bidders' representatives who choose to attend, at the address, date and time specified in BDS. The bidders' representatives who are present shall sign an attendance sheet evidencing their attendance.

24.2 Envelopes marked "WITHDRAWAL" shall be opened and read out first. Bids for which an acceptable notice of withdrawal has been submitted pursuant to Clause 23 shall not be opened.
Next, outer envelopes marked “MODIFICATION” shall be opened. No bid shall be modified unless the corresponding Modification Notice contains a valid authorization to request the modification and is read out and recorded at the opening of bids.
The bids, both Original as well as Modification, are to be opened, read out, and recorded at the opening.

(The Sub-clauses 24.1 and 24.2 are not applicable since bid shall be submitted by email with password protected)

24.3 The bidders' names, their bid prices, the total amount of each, any discount, modifications and withdrawals, the presence or absence of bid security and Integrity Pact, and such other details as the Employer may consider appropriate, will be announced and recorded by the Employer at the opening. The bidder's representatives will be

required to sign the record.

24.4 The Employer shall prepare, besides the record of bid opening, minutes of the bid opening, including the information disclosed to those present in accordance with Sub-Clause 24.3.

24.5 The Technical Evaluation will be based on:

a) Detail scope of works;
b) Technical description- Electrical/Mechanical/Thermal/Structural;
c) Drawings;
d) Work schedule and work methodology;
e) List of mandatory tools and tackles;
f) List of spares;
g) Type test certification for the electrical/mechanical/thermal equipment from accredited test house.
h) Proposal/recommendation for the technical back up services including supply of spares after defects liability period.

24.6 All bids shall be opened one at a time, and the following read out and recorded:

(a) the name of the Bidder;

(b) their bid price and the total amount

(c) whether there is a modification or substitution;

(d) the presence of a Bid Security, if required; and

(e) any other details as the Employer may consider appropriate.

Only bids read out and recorded at bid opening shall be considered for evaluation. No bid shall be rejected at the opening of bids except for late bids, in accordance with Clause 22.1.

25. **Bid Opening - Opening of Price Bids**

25.1 After the technical evaluation, the price bids of technically qualified Bidders shall be opened on such other date to be informed to the technically qualified bidders.

25.2 The Price envelopes, including Price modifications made pursuant to Clause 23, of the technically responsive bidders shall be opened. The Price envelopes of technically non-responsive bidders shall be retained unopened with BPC.

(The sub-clauses 25.1 & 25.2 are not applicable since bid shall be submitted by email with password protected)

25.3 The names of responsive Bidders, their bid prices, the total amount of each, any discount shall be announced and recorded by the Employer at the bid opening. Any bid price, discount or alternative bid price which is not read out and recorded at bid opening will not be taken in account in bid evaluation. The Bidders' representatives who are present shall sign an attendance sheet evidencing their attendance.

25.4 Financial evaluation of the bids shall be carried out by calculating the Rate Per Unit. The work will be awarded to the bidder whose Rate Per Unit (Ngultrum/kW) is found to be the lowest.

26. **Process to be Confidential**

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

27. **Clarification of Bids**

27.1 To assist in the examination, evaluation and comparison of bids, the Employer may, at its discretion, ask any bidder for clarification of its bid, including but not limited to (a) during evaluation of Technical Bids any information on the technical data/information provided, qualifying requirements and/or deviations taken by the Bidder or any other clarification deemed fit by the Employer and (b) during evaluation of Price Bids breakdowns of unit rates or any other clarifications deemed fit by the Employer. The request for clarification and the response shall be in writing or by fax, but no change in the price or substance of the bid shall be sought, offered or permitted except as required to confirm the correction of arithmetic errors discovered by the Employer in the evaluation of the bids in accordance with Clause 29. Also seeking of any clarifications shall not be construed as the Bidder having met all/any qualification requirements and the Employer's seeking such clarifications is without prejudice to the Employer's right to reject Bids which are not substantially responsive at the time of original Bid submission.

28. **Preliminary Examination of Bids and Determination**

28.1 Prior to the detailed evaluation of bids (during evaluation of technical Bids as well as the Financial Bids as appropriate), the Employer will determine whether each bid (i) meets the eligibility criteria;

of Responsiveness

(ii) has been properly signed; (iii) is accompanied by the required securities; (iv) is substantially responsive to the requirements of the bidding documents; and (v) provides any clarification and/or substantiation that the Employer may require pursuant to Clause 27.

28.2 A responsive bid is one which has duly filled and signed Integrity Pact and submitted along with the bid and conforms to the terms, conditions and specifications of the bidding documents, without material deviation or reservation. A material deviation or reservation is one (i) which affects in any substantial way the scope, quality or performance of the Works; (ii) which limits in any substantial way, inconsistent with the bidding documents, the Employer's rights or the bidder's obligations under the Contract; or (iii) whose rectification would affect unfairly the competitive position of other bidders presenting substantially responsive bids.

28.3 If a bid is not responsive, it will be rejected by the Employer, and may not subsequently be made responsive by correction or withdrawal of the nonconforming deviation or reservation.

29. **Correction of Errors**

29.1 Bids determined to be substantially responsive will be checked by the Employer for any arithmetic errors. Arithmetic errors will be rectified on the following basis. If there is a discrepancy between the unit rate and the total cost per item that is obtained by multiplying the unit rate and quantity, the unit rate shall prevail and the total cost per item will be corrected unless in the opinion of the Employer there is an obvious misplacement of the decimal point in the unit rate, in which case the total cost per item as quoted will govern and the unit rate corrected. If there is a discrepancy between the total bid amount and the sum of total costs per item, the sum of the total costs per item shall prevail and the total bid amount will be corrected.

For the purpose of evaluation of price bids, the amounts in currencies in which the bid price is offered in respect of the substantially responsive bids will be converted to India Rupees/Bhutan Ngultrum at the Bills Selling Rate of Exchange published by the Royal Monetary Authority of Bhutan prevailing on the date of bid opening.

29.2 The amount stated in the Form of Price Bid will be adjusted by the Employer in accordance with the above procedure for the correction of errors and, shall be considered as binding upon the bidder. If the bidder does not accept the corrected amount of bid, its bid will be rejected, and the bid security may be forfeited in accordance with Sub-Clause 16.6 (b).

30. **Evaluation and Comparison of Bids**

30.1 The Employer will evaluate and compare only the bids determined to be responsive in accordance with Clause 28.

30.2 In evaluating the bids, the Employer will determine for each bid the Evaluated Bid Price by adjusting the Bid Price as follows :

(a) making any correction for errors pursuant to Clause 29;
(b) excluding Provisional Sums and the provision, if any, for Contingencies in the Summary Bill of Quantities, but including Day work, where priced competitively;
(c) making an appropriate adjustment for any other acceptable variations, deviations or alternative offers submitted in accordance with Clause 17; and
(d) applying any discounts offered by the bidder for the award.

30.3 The Employer reserves the right to accept or reject any variation or deviations. Variations and other factors which are in excess of the requirements of the bidding documents or otherwise result in the accrual of unsolicited benefits to the Employer shall not be taken into account in bid evaluation.

30.4 The estimated effect of the price adjustment provisions of the Conditions of Contract, applied over the period of execution of the Contract, shall not be taken into account in bid evaluation.

30.5 If the bid of the successful bidder is seriously unbalanced in relation to the Engineer's estimate of the cost of work to be performed under the Contract, the Employer may require the bidder to produce detailed price analyses for any or all items of the Bill of Quantities, to demonstrate the internal consistency of those prices with the construction methods and schedule proposed. After evaluation of the price analyses, the Employer may require that the amount of the performance security set forth in Clause 35 be increased at the expense of the successful bidder to a level sufficient to protect the

Employer against financial loss in the event of default of the successful bidder under the Contract.

F. AWARD OF CONTRACT

31. **Award**

31.1 Subject to Clause 32, the Employer will award the Contract to the bidder whose bid has been determined to be substantially responsive to the bidding documents and who has offered the Lowest Evaluated Bid Price, provided that such bidder has been determined to be (i) eligible in accordance with the provisions of Sub-Clause 2.1; and (ii) qualified in accordance with the provisions of Clause 4.

It is not binding on the Employer to place order on the lowest (evaluated) priced Bid. The reasonability of price will be duly considered in the evaluation.

32. **Employer's Right to Accept any Bid and to Reject any or all Bids**

32.1 Bids will be rejected if:

a) Any conditional bids other than those offering conditional discounts pursuant to Clause 30.2 (d)
b) Bids that do not comply with completion time
c) Bids which are non-responsive pursuant to Clause 28.
d) A bid contains any false statement.
e) A bid doesn't meet all the qualification criteria pursuant to Clause 4. The bids of only those bidders who meet the stated requirement/criteria will be considered for further evaluation.
f) Validity of bid security is not as per clause 16.
g) A bidder doesn't accept and comply with the following clauses as given in the Tender Document:
   - Performance Guarantee Bond Clause
   - Warranty Clause
   - Force Majeure Clause
   - Insurance Clause
   - Arbitration Clause
   - Acceptance of Jurisdiction and Applicable law
   - Liquidated damage cum penalty clause.

32.2 Notwithstanding Clause 31, the Employer reserves the right to accept or reject any bid, and to annul the bidding process and reject all bids, at any time prior to award of Contract, 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.

33. **Notification of Award**

33.1 Prior to expiration of the period of bid validity prescribed by the Employer, the Employer will notify the successful bidder by fax confirmed by registered letter that its bid has been accepted. This letter (hereinafter called the "Letter of Acceptance") shall name the sum which the Employer will pay the Contractor in consideration of the execution, completion and maintenance of the Works by the Contractor as prescribed by the Contract (hereinafter and in the Conditions of Contract called "the Contract Price").

33.2 The notification of award will constitute the formation of the Contract, unless such notification is conditional upon any pre-award discussions/negotiations at the discretion of the Employer.

33.3 Upon the furnishing by the successful bidder of a performance security, the Employer will promptly notify the other bidders that their bids have been unsuccessful.

34. **Signing of Agreement**

34.1 At the same time that the Employer notifies the successful bidder that its bid has been accepted. The Employer will intimate the date of signing of the agreement to the Bidder.

34.2 The Agreement shall be signed within seven (7) working days of receipt of Letter of Acceptance from the Employer.

35. **Performance Security**

35.1 Within seven (7) working days of receipt of the Letter of Acceptance from the Employer, the successful bidder shall furnish to the Employer a performance security in an amount of ten (10) percent of the Contract Price in accordance with the Conditions of Contract. The form of performance security provided in Part I of Volume 2 of the bidding documents shall be used.

35.2 Failure of the successful bidder to comply with the requirements of Clauses 34 or 35 shall constitute sufficient grounds for the annulment of the award and forfeiture of the bid security.

36. **Fraud & Corruption**

36.1 It is Royal Government of Bhutan's (RGoB) policy to require that Employers, Bidders, Suppliers, Contractors and their Subcontractors observe the highest standards of ethics during the procurement and execution of contracts. In pursuance to this policy the Employer/RGoB:

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

(i) "corrupt practice" is the offering, giving, receiving or soliciting, directly or indirectly, of anything of value to influence improperly the actions of another party;

(ii) "fraudulent practice" is any intentional act or omission, including a misrepresentation, that knowingly or recklessly misleads, or attempts to mislead, a party to obtain a financial or other benefit or to avoid an obligation;

(iii) "collusive practice" is an arrangement between two or more parties designed to achieve an improper purpose, including to influence improperly the actions of another party'

(iv) "coercive practice" is impairing or harming, or threatening to impair or harm, directly or indirectly, any party or the property of the party to influence improperly the action of a party;

(v) "obstructive practice" is deliberately destroying, falsifying, altering or concealing of evidence material to the investigation or making false statements to investigators in order to materially impede any investigation into allegations of a corrupt, fraudulent, coercive or collusive practice; and/or threatening, harassing or intimidating any party to prevent it from disclosing its knowledge of matters relevant to investigation or from pursuing the investigation; or acts intended to materially impede the exercise of the inspection and audit rights of the Employer or any organization or person appointed by the Employer.

(b) will reject a proposal for award if it determines that the bidder recommended for award has, directly or through an agent, engaged in corrupt, fraudulent, collusive, coercive or obstructive practices in competing for the contract in question

(c) will sanction a firm or an individual, including declaring them ineligible, either indefinitely or for a stated period of time, to be awarded a contract if it at any time determines that they have, directly or through an agent, engaged in corrupt, fraudulent, collusive, coercive or obstructive practices in competing for, or in executing contract;

(d) will have the right to require that a provision be included in the bidding documents and in contracts, requiring bidders, suppliers, contractors and their subcontractors to permit the Employer, any organization or person appointed by the Employer and/or any relevant RGoB agency to inspect their accounts and records and other documents relating to the bid submission and contract performance and to have them audited by auditors appointed by the Employer;

(e) requires that bidders, as a condition to admission to eligibility, execute and attach to their bids an Integrity Pact Statement in the form provided in the Instructions to bidders.

(f) will report any case of corrupt, fraudulent, collusive, coercive or obstructive practice to relevant RGoB agencies, including but not limited to the Anti-Corruption Commission (ACC) of Bhutan, for necessary action in accordance with the statutes and provisions of the relevant agency.

G. BID DATA SHEET

ITB 6.1	Those who have downloaded & printed the bidding document should register with RED, BPC with on or before the closing of the bid sale date with application via email and upon payment of Nu. 200 (Ngultrum two hundred only) to make the bid enforceable.
ITB 15.1	The bid validity period shall be 60 days from the date of submission.
ITB 16.1	The bidder shall furnish a bid security in the amount of Nu 365,000.00 (Ngultrum Three Hundred Sixty Five Thousand Only) or an equivalent amount in a freely convertible currency. For the purpose of determining the equivalent amount of the required Bid Security in a freely convertible currency, the exchange rates published by Royal Monetary Authority of Bhutan (RMA) prevailing on the date 28 days prior to the deadline for bid submission shall be applied.
ITB 18.1	A Pre-Bid meeting will take place as follows: Date: _____ (Not Applicable for this bid). Time: _____ hours The date of site visit: _____
ITB 20.3 (b)	For **bid submission purpose only**, the Employer's address is: Mr. Pema Wangchuk Manager Renewable Energy Division Distribution Construction Department Bhutan Power Corporation Limited Yarden Lam, PO Box No. 580 Thimphu, Bhutan For **clarification purposes only**, the Employer's address is: Mr. Pema Wangchuk Manager Renewable Energy Division Distribution Construction Department Bhutan Power Corporation Limited Yarden Lam, PO Box No. 580 Thimphu, Bhutan Tel : +975-2-332356 Email: pema_wangchuk@bpc.bt

ITB 20.3 (c)	The bid shall bear the following specific identification: The name of the International Competitive Bidding (ICB) Document is: Supply, Installation, Testing and Commissioning of 180kW Grid-Tied Ground-Mounted Solar PV Project at Rubessa, Wangduephodrang, Bhutan. The identification/reference number of the ICB is: **08/BPC/RED/DCD/2020/Vol-I/46**
ITB 21.1	The deadline for bid submission is: Date : 07/10/2020 Time: 13:00 hours
ITB 24.1	The bid opening of shall take place at: (**The bid shall be opened online**) Date: 07/10/2020 Time: 14:30 hours

Section 1B – General Conditions of Contract (GCC) for E&M Works

FEDERATION INTERNATIONALE DES INGENIEURS-CONSEILS

CONDITIONS OF CONTRACT FOR ELECTRICAL AND MECHANICAL WORKS

INCLUDING ERECTION ON SITE

WITH FORMS OF TENDER AND AGREEMENT

THIRD EDITION 1987
ISBN 2-88432-000-8

First published by
Fédération Internationale des
Ingénieurs-Conseils (FIDIC)
P O BOX 311
1215 Geneva 15
Switzerland
Tel : +41 22 799 4900
Fax :+41 22 799 4901
Email: fidic@fidic.org

Reprinted May 1988
(with editorial amendments)

Produced for FIDIC by
Rhys Jones Consultants,
London UK.

FEDERATION INTERNATIONALE DES INGENIEURS-CONSEILS

CONDITIONS OF CONTRACT FOR ELECTRICAL AND MECHANICAL WORKS

INCLUDING ERECTION ON SITE

WITH FORMS OF TENDER AND AGREEMENT

THIRD EDITION 1987
Reprinted 1988 with editorial amendments

ACKNOWLEDGEMENTS

FIDIC gratefully acknowledges the advice and comment it has received during the preparation of this edition from ORGALIME — Organisme de Liaison des Industries Métalliques Européennes.

However, FIDIC has been solely responsible for decisions concerning the content of the document and the above acknowledgement does not imply approval by ORGALIME of the conditions contained herein.

FIDIC gratefully acknowledges the work of the members of the Electrical and Mechanical Contracts Committee composed of members of FIDIC Member Associations who have donated their expertise and time to make the production of this edition possible.

CONTENTS

PREAMBLE

This Preamble must be completed in all cases referring to completed schedules where appropriate. When completed, this Preamble, the General Conditions, Specification, Employer's and Contractor's Drawings, Schedules and other documents can constitute a contract on the basis of the General Conditions in Part I. If this is not what is required, Part II must also be completed.

Commencement Date

Sub-Clause 1.1.1.(i)
The date for commencement of the Works is _____

The Employer

Sub-Clause 1.1.12.

The Employer is _____

The Engineer

Sub-Clause 1.1.15.

The Engineer is _____

Time for Completion

Sub-Clause 1.1.35.

The Time for Completion is _____ days from the Commencement Date.

Contractor's Profit

Sub-Clause 1.6.

The percentage to cover profit entitlement, where appropriate, is _____%.

Ruling Language

Sub-Clause 5.1.

The version in _____ language (ruling language) shall prevail.

Day to Day Communications

Sub-Clause 5.2

The language for day to day communications is _____

Programme to be Furnished

Sub-Clause 12.1.

The Programme must be submitted in the form of _____

_____

Electricity Water, Gas and Other Services

Sub-Clause 14.3.

Supplies on the Site are:

a. Electricity: _____

_____

_____

b. Water: _____

_____

_____

c. Gas: _____

_____

_____

d. Other services: _____

_____

_____

Employer's Equipment

Sub-Clause 14.4.

The following Employer's equipment is available for use by the Contractor under the Employer's operation: _____

_____

_____

Working Hours

Sub-Clause 18.3.

The normal working hours are _____

_____

Delay in Completion

Sub-Clause 27.1.

Failure to meet the Time for Completion entitles the Employer to reduction in Contract Price as follows:

Percentage per day _____ %

Maximum _____ %

Prolonged Delay

Sub-Clause 27.2.

Maximum amount recoverable from the Contractor by the Employer:

_____

Terms of Payment

Sub-Clause 33.1.

In addition to the provisions under Clause 33, the terms of payment shall be:

_____

_____

Payment in Foreign Currencies

Sub-Clause 35.1.

Payment in foreign currencies shall be arranged as follows:

_____

_____

Rates of Exchange

Sub-Clause 35.3.

The rates of exchange for the purpose of the Contract are:

_____

_____

Payment against Provisional Sums

Sub-Clause 36.4.(b)

The percentage to be applied to Provisional Sums shall be _____%.

Maximum Liability

Sub-Clause 42.2.

The maximum liability of the Contractor to the Employer shall be

_____

Insurance of Works

Sub-Clause 43.1.

The deductible limits in the insurance cover of the Works shall not exceed _____

Sub-Clause 43.1. (a)

The additional risks to be insured are:

_____

_____

Third Party Liability

Sub-Clause 43.3.

The amount of insurance against third party liability taken out by the Contractor shall not be less than:

_____

Payment on Termination for Employer's Default

Sub-Clause 46.3.

The additional amount payable by the Employer on termination shall not exceed:

_____

Labour, Materials and Transport

Sub-Clause 47.1.

The method of calculating adjustments for changes in costs shall be:

_____

_____

Notices to Employer and Engineer

Sub-Clause 49.2.

The address of the Employer for notices is:

_____

_____

The address of the Engineer for notices is:

_____

_____

Applicable Law

Sub-Clause 51.1.

The applicable law is _____ law.

Procedural Law for Arbitration

Sub-Clause 51.2.

The procedural law for arbitration is

_____

Language and Place of Arbitration

Sub-Clause 51.3.

The language of arbitration is _____ language.

The place of arbitration is

_____

PART I: GENERAL CONDITIONS

Definitions and Interpretations

Definitions **1.1** In the Contract (as hereinafter defined) the following words and expressions shall have the meanings hereby assigned to them:

1.1.1 "Commencement Date" means whichever is the latest of:

i) the date specified in the Preamble as the date for commencement of the Works or the date when the Contractor receives:

ii) such payment in advance of the commencement of the Works as may be specified in the terms of payment, or

iii) notice of the issue of any import licence necessary for commencing performance of the Contract, or

iv) notice that any legal requirements necessary for the Contract to enter into force have been fulfilled, or

v) notice that any necessary financial or administrative requirements specified in Part II as conditions precedent to commencement have been fulfilled.

1.1.2 "Conditions" means the Preamble to and these Conditions of Contract, Parts I and II.

1.1.3 "Contract" means the agreement between the Employer and the Contractor for the execution of the Works incorporating the Conditions, Specification, Employer's Drawings and Contractor's Drawings, priced and completed Schedules, Tender, Letter of Acceptance and such further documents as may be expressly incorporated by the Letter of Acceptance.

1.1.4 "Contract Agreement" means the document recording the terms of the Contract between the Employer and the Contractor.

1.1.5 "Contract Price" means the sum stated in the Letter of Acceptance as payable to the Contractor for the execution of the Works.

1.1.6 "Contractor" means the person whose tender has been accepted by the Employer and the legal successors in title to the Contractor but not (except with the consent of the Employer) any assignee of the Contractor.

1.1.7 "Contractor's Drawings" means all drawings, samples, patterns, models and operation and maintenance manuals to be submitted by the Contractor in accordance with Clause 6.

1.1.8 "Contractor's Equipment" means all appliances or things of whatsoever nature required for the purposes of the Works but does not include Plant.

1.1.9 "Contractor's Risks" means the risks defined in Sub-Clause 37.3.

1.1.10 "Defects Liability Certificate" means the certificate to be issued by the Engineer to the Contractor in accordance with Sub-Clause 30.11.

1.1.11 "Defects Liability Period" means one year or the period stated in Part II following taking over, during which the Contractor is responsible for making good defects and damage in accordance with Clause 30.

1.1.12 "Employer" means the person named as such in the Preamble and the legal successors in title to the Employer but not (except with the consent of the Contractor) any assignee of the Employer.

1.1.13 "Employer's Drawings" means all the drawings and information provided by the Employer or the Engineer to the Contractor under the Contract.

1.1.14 "Employer's Risks" means those risks defined in Sub-Clause 37.2.

1.1.15 "Engineer" means the person appointed by the Employer to act as Engineer for the purposes of the Contract and designated as such in the Preamble.

1.1.16 "Engineer's Representative" means any representative of the Engineer appointed from time to time by the Engineer under Sub-Clause 2.2.

1.1.17 "Final Certificate of Payment", means the certificate to be issued by the Engineer to the Employer in accordance with Sub-Clause 33.10.

1.1.18 "Force Majeure" has the meaning assigned to it under Sub-Clause 44.1.

1.1.19 "Foreign Currency" means a currency of a country other than that in which Plant is to be installed.

1.1.20 "Gross Misconduct" means any act or omission of the Contractor in violation of the most elementary rules of diligence which a conscientous contractor in the same position and under the same circumstances would have followed.

1.1.21 "Letter of Acceptance" means the formal acceptance by the Employer of the Tender incorporating any adjustments or variations to the Tender agreed between the Employer and the Contractor.

1.1.22 "Performance Security" means the security to be provided by the Contractor in accordance with Sub-Clause 10.1. for the due performance of the Contract.

1.1.23 "Plant" means machinery, apparatus, materials and all things to be provided under the Contract for incorporation in the Works.

1.1.24 "Programme" means the Programme to be submitted by the Contractor in accordance with Sub-Clause 12.1. and any approved revisions thereto.

1.1.25 "Provisional Sum" means a sum, described as such for the execution of work or for the supply of goods or services, to be used in accordance with Sub-Clause 36.1.

1.1.26 "Risk Transfer Date" means the date when the risk of loss of or damage to the Works passes from the Contractor to the Employer in accordance with Sub-Clause 39.1.

1.1.27 "Schedule of Prices" means the completed and priced Schedule of Prices, or any part or individual schedule thereof, submitted by the Contractor with his Tender and forming a part of the Contract documents.

1.1.28 "Section" means a part of the Works specifically identified as such in the Contract.

1.1.29 "Site" means the place or places, provided or made available by the Employer where work is to be done by the Contractor or to which Plant is to be delivered, together with so much of the area surrounding the same as the Contractor shall with the consent of the Employer use in connection with the Works otherwise than merely for the purposes of access.

1.1.30 "Specification" means the specification of the Works included in the Contract and any modification thereof made under Clause 31.

1.1.31 "Subcontractor" means any person (other than the Contractor) named in the Contract for any part of the Works, or any person to whom any part of the Contract has been subcontracted with the consent of the Engineer, and the Subcontractor's legal successors in title but not any assignee of the Subcontractor.

1.1.32 "Taking-Over Certificate" means the certificate to be given by the Engineer to the Contractor in accordance with Clause 29.

1.1.33 "Tender" means the Contractor's priced offer to the Employer for the execution of the Works.

1.1.34 "Tests on Completion" means the tests specified in the Contract or otherwise agreed by the Engineer and the Contractor to be performed before the Works are taken over by the Employer.

1.1.35 "Time for Completion" means the time stated in the Preamble for completing the Works or any Section thereof and passing the Tests on Completion calculated from the Commencement Date unless extended in accordance with Clause 26.

1.1.36 "Variation Order" means any written order, identified as such, issued to the Contractor by the Engineer under Sub-Clause 31.1.

1.1.37 "Works" means all Plant to be provided and work to be done by the Contractor under the Contract.

Headings and Titles

1.2 The headings and titles in these Conditions shall not be deemed part thereof or be taken into consideration in the interpretation or construction of the Contract.

Interpretation

1.3 Words importing persons or parties shall include firms and corporations and any organisation having legal capacity.

Words importing the singular only also include the plural and vice versa where the context requires.

Written Communications

1.4 Wherever in the Contract provision is made for a communication to be "written" or "in writing" this means any hand-written, type-written or printed communication, including telex, cable and facsimile transmission.

Notices, Consents and Approvals

1.5 Wherever in the Contract provision is made for the giving of notice, consent or approval by any person, such consent or approval shall not be unreasonably withheld. Unless otherwise specified, such notice, consent or approval shall be in writing and the word "notify" shall be construed accordingly.

Costs, Overhead Charges and Profit

1.6 Whenever by these Conditions the Contractor is entitled to be paid cost, such cost shall be properly incurred and shall include any overhead charges properly allocable thereto but not profit unless so stated. Any profit entitlement shall be added to cost at the percentage stated in the Preamble.

Periods

1.7 In these Conditions "day" means calendar day and "year" means 365 days.

Engineer and Engineer's Representative

Engineer's Duties

2.1 The Engineer shall carry out the duties specified in the Contract.

If the Engineer is required, under the terms of his appointment by the Employer, to obtain the specific approval of the Employer before carrying out any of these duties, full particulars of such requirements shall be set out in Part II.

Except as expressly stated in the Contract the Engineer shall have no authority to relieve the Contractor of any of his obligations under the Contract.

Engineer's Representative

2.2 The Engineer's Representative shall be appointed by and be responsible to the Engineer and shall only carry out such duties and exercise such authority as may be delegated to him by the Engineer under Sub-Clause 2.3.

Engineer's Power to Delegate

2.3 The Engineer may from time to time delegate to the Engineer's Representative any of the duties vested in the Engineer and may at any time revoke such delegation.

Any such delegation or revocation shall be in writing and shall not take effect until a copy thereof has been delivered to the Contractor and the Employer.

Any decision, instruction or approval given by the Engineer's Representative to the Contractor in accordance with such delegation shall have the same effect as though it had been given by the Engineer. However:

(a) any failure of the Engineer's Representative to disapprove any Plant or workmanship shall not prejudice the right of the Engineer to disapprove such Plant or workmanship and to give instructions for the rectification thereof;

(b) if the Contractor questions any decision or instruction of the Engineer's Representative he may refer the matter to the Engineer who shall confirm, reverse or vary such decision or instruction.

Engineer to Act Impartially

2.4 Wherever under the Contract the Engineer is required to exercise his discretion by:

(a) giving his decision, opinion or consent, or

(b) expressing his satisfaction or approval, or

(c) determining value, or

(d) otherwise taking action which may affect the rights and obligations of the Employer or the Contractor,

he shall exercise such discretion impartially within the terms of the Contract and having regard to all the circumstances.

Engineer's Decisions and Instructions

2.5 The Contractor shall proceed with the decisions and instructions given by the Engineer in accordance with these Conditions.

Confirmation in Writing

2.6 The Contractor may require the Engineer to confirm in writing any decision or instruction of the Engineer which is not in writing. The Contractor shall notify the Engineer of such requirement without undue delay. Such a decision or instruction shall not be effective until written confirmation thereof has been received by the Contractor.

Disputing Engineer's Decisions and Instructions

2.7 If the Contractor disputes or questions any decision or instruction under Clause 2.5 or a written confirmation under Clause 2.6, he shall give notice to the Engineer within 28 days after receipt thereof, giving his reasons.

The Engineer shall within a further period of 28 days by notice to the Contractor and the Employer with reasons, confirm, reverse or vary such decision or instruction.

If either party disagrees with the action taken by the Engineer, or if the Engineer fails to reply to the Contractor's notice within the stipulated 28 days, and the matter cannot be settled amicably that party shall be at liberty, subject to Sub-Clause 50.1, to refer the matter to arbitration in accordance with the Contract.

Replacement of Engineer

2.8 The Employer shall not appoint any person to act in replacement of the Engineer without the consent of the Contractor.

Assignment and Subcontracting

Assignment **3.1** The Contractor shall not assign the Contract or any part of his obligations under the Contract. A charge in favour of the Contractor's bankers of any monies due under the Contract shall not be considered an assignment.

Subcontracting **4.1** The Contractor shall not subcontract the whole of the Works.

Except where otherwise provided by the Contract the Contractor shall not subcontract any part of the Works without the prior consent of the Engineer.

The Contractor shall however, not require such consent for purchases of materials or to place contracts for minor details or for any part of the Works of which the manufacturer or supplier is named in the Contract.

The Contractor shall be responsible for the acts, defaults and neglects of any Subcontractor, his agents or employees as fully as if they were the acts, defaults or neglects of the Contractor, his agents or employees.

Contract Documents

Ruling Language **5.1** Where versions of the Contract are prepared in different languages, the version which is to prevail shall be specified in the Preamble. The language of such version is referred to as the ruling language.

Day to Day Communications **5.2** The language for day to day communications is stated in the Preamble.

Priority of Contract Documents **5.3** Unless otherwise provided in the Contract the priority of the Contract documents shall be as follows:

1. The Letter of Acceptance
2. The Preamble
3. The Conditions of Contract, Part II
4. The Conditions of Contract, Part I
5. Any other documents forming part of the Contract.

Documents Mutually Explanatory **5.4** Subject to Sub-Clause 5.3. the Contract documents shall be taken as mutually explanatory. Any ambiguities or discrepancies shall be resolved by the Engineer, who shall then instruct the Contractor thereon.

If the Contractor considers that compliance with such instructions will result in any cost which the Contractor could not reasonably have anticipated, he shall forthwith inform the Engineer with full supporting details. The Engineer shall then, if he approves, certify such costs as may be reasonable, together with profit where appropriate, which shall be added to the Contract Price.

If on the other hand compliance with such instructions results in lower costs for the Contractor than he had reason to anticipate, the Engineer shall certify a deduction from the Contract Price allowing for profit where appropriate.

Contractor's Drawings **6.1** The Contractor shall submit to the Engineer for approval:

(a) within the time given in the Contract or in the Programme such drawings, samples, models or information as may be called for therein, and in the numbers therein required, and

(b) during the progress of the Works, such drawings of the general arrangement and details of the Works as specified in the Contract or as the Engineer may require.

The Engineer shall signify his approval or disapproval thereof. If he fails to do so within the time given in the Contract or the Programme or if no time limit is specified, within 28 days of receipt, they shall be deemed to be approved.

Approved drawings, samples and models shall be signed or otherwise identified by the Engineer.

The Contractor shall supply additional copies of approved drawings in the form and numbers stated in the Contract.

Consequences of Disapproval of Contractor's Drawings

6.2 Any Contractor's Drawings which the Engineer disapproves, shall be forthwith modified to meet the requirements of the Engineer and shall be re-submitted.

Approved Contractor's Drawings

6.3 Approved Contractor's Drawings shall not be departed from except as provided in Clause 31.

Inspection of Contractor's Drawings

6.4 The Engineer shall have the right at all reasonable times to inspect, at the Contractor's premises, all Contractor's Drawings of any part of the Works.

Erection Information

6.5 The Contractor shall provide, within the times stated in the Contract or in the Programme, drawings showing how the Plant is to be affixed and any other information required for:

(a) preparing suitable foundations or other means of support, and

(b) providing suitable access on the Site for the Plant and any necessary equipment to the place where the Plant is to be erected, and

(c) making necessary connections to the Plant.

Operation and Maintenance Manuals

6.6 Before the Works are taken over in accordance with Clause 29 the Contractor shall supply operation and maintenance manuals together with drawings of the Works as built. These shall be in such detail as will enable the Employer to operate, maintain, adjust and repair all parts of the Works.

Unless otherwise stated in Part II the manuals and drawings shall be in the ruling language, and in such form and numbers as stated in the Contract.

Unless otherwise agreed, the Works shall not be considered to be completed for the purposes of taking over until such manuals and drawings have been supplied to the Employer.

Employer's Use of Contractor's Drawings

6.7 Contractor's Drawings may be used by the Employer for no other purpose than completing, operating, maintaining, adjusting and repairing the Works.

Contractor's Use of Employer's Drawings

6.8 The Employer's Drawings, Specification and other information submitted by the Employer or the Engineer to the Contractor shall remain the property of the Employer. They shall not, without the consent of the Employer, be used, copied or communicated to a third party by the Contractor unless necessary for the purposes of the Contract.

Manufacturing Drawings

6.9 Unless otherwise specified in Part II the Contractor shall not be required to disclose to the Employer or the Engineer the Contractor's confidential manufacturing drawings, designs, know-how or manufacturing practices, processes or operations.

Errors in Contractor's Drawings

7.1 The Contractor shall be responsible for any errors or omissions in the Contractor's Drawings unless they are due to incorrect Employer's Drawings or other written information supplied by the Employer or the Engineer. Approval by the Engineer of the Contractor's Drawings shall not relieve the Contractor from any responsibility under this Sub-Clause.

The Contractor shall bear any costs he may incur as a result of delay in providing Contractor's Drawings and other information or as a result of errors or omissions therein, for which the Contractor is responsible.

The Contractor shall at his own cost carry out any alterations or remedial work necessitated by such errors or omissions for which he is responsible and modify the Contractor's Drawings and such other information accordingly.

The performance of his obligations under this Clause shall be in full satisfaction of the Contractor's liability under this Clause but shall not relieve him of his liability under Sub-Clause 27.1.

Errors by Employer or Engineer **7.2** The Employer shall be responsible for the Employer's Drawings and for other written information supplied by the Employer or the Engineer and for the details of special work specified by either of them. If such Employer's Drawings, information or details are incorrect and necessitate alterations of the work, the Employer shall pay the Contractor the cost of the alterations together with profit as certified by the Engineer.

Obligations of the Contractor

General Obligations **8.1** The Contractor shall, in accordance with the Contract, with due care and diligence, design, manufacture, deliver to Site, erect, test and commission the Plant and carry out the Works within the Time for Completion. The Contractor shall also provide all necessary Contractor's Equipment, superintendence, labour and, except as stated in Part II, all necessary facilities therefor.

Setting Out **8.2** The Contractor shall set out the Works in relation to original points, lines and levels of reference given by the Engineer in writing and provide all necessary instruments, appliances and labour for such purposes.

If, at any time during the execution of the Works, any error appears in the positions, levels, dimensions or alignment of the Works, the Contractor shall rectify the error.

The Contractor shall bear the cost of rectifying the error, unless the error results from incorrect information supplied in writing by the Employer, the Engineer or from default by another contractor, in which case the cost together with profit shall be borne by the Employer.

The checking of any setting-out by the Engineer shall not relieve the Contractor of his responsibility for the accuracy thereof.

Contract Agreement **9.1** The Contractor shall, if called upon so to do, execute a Contract Agreement recording all the terms of the Contract, to be prepared by and completed at the cost of the Employer in the form annexed hereto.

Performance Security **10.1** If Part II requires the Contractor to obtain a Performance Security, he shall obtain the same in the sum required, within 28 days after the receipt of the Letter of Acceptance. The Performance Security shall be provided by a person and in a form approved by the Employer. The cost of complying with the requirements of this Clause shall be borne by the Contractor.

Period of Validity **10.2** The Performance Security shall be valid until the Contractor has executed, completed and remedied defects in the Works in accordance with the Contract. No claim shall be made against the Performance Security after the issue of the Defects Liability Certificate and the Performance Security shall be returned to the Contractor within 14 days of the issue of the Defects Liability Certificate.

Claims under Performance Security **10.3** Whether or not the Performance Security is stated by its terms to be payable on the demand of the Employer the Employer shall not make a claim under the Performance Security unless one of the following conditions is satisfied:

(a) the Contractor is in breach of the Contract and fails to remedy the breach within 42 days after receiving written notice from the Employer requiring him so to do. The notice shall state the intention to claim under the Performance Security, the amount claimed and the breach relied upon, or

(b) the Employer and the Contractor have agreed in writing that the amount demanded is payable to the Employer, and the amount has not been paid within 42 days thereafter, or

(c) the Employer has obtained an award in arbitration under Clause 50 and the amount awarded has not been paid within 42 days after the award, or

(d) the Contractor has gone into liquidation or is bankrupt.

In every case the Employer shall, when making the claim, send a copy to the Contractor.

Site Data **11.1** The Tender shall be deemed to have been based on such data on climatic, hydrological and general conditions on the Site and for the operation of the Works as the Employer or the Engineer has made available to the Contractor for the purposes of the Tender. The Contractor shall be responsible for his own interpretation of such data.

Sufficiency of Contract Price **11.2** The Contractor shall be deemed to have satisfied himself on and taken account of in his Tender:

(a) all the conditions and circumstances affecting the Contract Price,

(b) the possibility of carrying out the Works as described in the Contract,

(c) the general circumstances at the Site (if access has been made available to him) and

(d) the general labour position at the Site.

The Contractor shall not be responsible for the accuracy of information given in writing by the Employer or the Engineer but shall be responsible for his interpretation of information received from whatever source.

Physical Obstructions and Conditions **11.3** If during the execution of the Works on Site the Contractor encounters physical obstructions or conditions of the kind stipulated in Sub-Clause 26.1. c) the Contractor shall be entitled to recover the additional cost incurred in consequence.

The Engineer shall certify and there shall be added to the Contract Price the additional cost of:

(a) complying with any instruction which the Engineer, after due consultation with the Employer and the Contractor, issues to the Contractor in connection therewith, and

(b) any necessary measures which the Contractor may take in the absence of specific instructions from the Engineer.

Programme to be Furnished **12.1** The Contractor shall submit to the Engineer for his approval the Programme which shall contain the following:

(a) the order in which the Contractor proposes to carry out the Works (including design, manufacture, delivery to Site, erection, testing and commissioning),

(b) the times when submission and approval of the Contractor's Drawings are required,

(c) the times by which the Contractor requires the Employer:

(i) to furnish any Employer's Drawings,
(ii) to provide access to the Site,
(iii) to have completed the necessary civil engineering work (including foundations for the Plant) and
(iv) to have obtained any import licences, consents, wayleaves and approvals necessary for the purpose of the Works.

The Contractor shall submit the Programme in the form stated in the Preamble within 28 days after the Commencement Date.

The approval by the Engineer of the Programme shall not relieve the Contractor or the Employer from any obligation under the Contract.

Alteration to Programme **12.2** No material alteration to the Programme shall be made without the approval of the Engineer.

Revision of Programme **12.3** If the progress of the Works does not conform to the Programme, the Engineer may instruct the Contractor to revise the Programme.

If such modifications are required for reasons for which the Contractor is not responsible, the cost of preparing the revised Programme shall be certified by the Engineer and added to the Contract Price.

Contractor's Representative **13.1** The Contractor shall employ one or more competent representatives to superintend the carrying out of the Works on Site. They shall be fluent in the language for day to day communications. Their names shall be communicated in writing to the Engineer before work on Site begins.

Any instruction or notice which the Engineer gives to the Contractor's representatives shall be deemed to have been given to the Contractor.

Objection to Contractor's Employees **13.2** The Contractor shall, upon the Engineer's written instruction, remove from the Works any person employed by him in the execution of the Works, who misconducts himself or is incompetent or negligent.

Contractor's Equipment **14.1** Except to the extent specified in Part II, the Contractor shall provide all Contractor's Equipment necessary to complete the Works.

All Contractor's Equipment shall, when brought on to the Site, be deemed to be exclusively intended for the execution of the Works. The Contractor shall not remove from the Site any such equipment, except:

(a) when it is no longer required for the completion of the Works, or

(b) when the Engineer has given his consent.

Safety Precautions **14.2** The Contractor shall observe all applicable regulations regarding safety on the Site.

Unless otherwise agreed, the Contractor shall, from the commencement of work on Site until taking over provide:

(a) fencing, lighting, guarding and watching of the Works, and

(b) temporary roadways, footways, guards and fences which may be necessary for the accommodation and protection of owners and occupiers of adjacent property, the public and others.

Electricity, Water and Gas **14.3** The Contractor shall be entitled to use for the purposes of the Works such supplies of electricity, water, gas and other services as may be available on the Site and of which details are given in the Preamble. The Contractor shall pay the Employer a fair price for such use. The Contractor shall at his own cost provide any apparatus necessary for such use.

Employer's Equipment 14.4 The Employer shall, if the Contractor so requests for the execution of the Works, operate any available equipment of which details are given in the Preamble. The Contractor shall pay the Employer a fair price for such use.

The Employer shall during such operation retain control of and be responsible for the safe working of the equipment.

Clearance of Site 14.5 The Contractor shall from time to time during the progress of the Works clear away and remove all surplus materials and rubbish. On completion of the Works the Contractor shall remove all Contractor's Equipment and leave the whole of the Site and the Works clean and in a workmanlike condition, to the satisfaction of the Engineer.

Opportunities for Other Contractors 14.6 The Contractor shall, in accordance with the Engineer's instructions, afford to other contractors engaged by the Employer to work on the Site and persons lawfully upon the Site all reasonable opportunities for carrying out their work provided that the same shall not obstruct or disturb the progress of the Works. The Contractor shall also afford such opportunities to the employees of the Employer.

If the Contractor, on the written request of the Engineer, makes available any Contractor's Equipment or provides any other service, the Employer shall pay the Contractor accordingly. The amount to be paid shall be certified by the Engineer and added to the Contract Price.

Authority for Access 14.7 No persons other than the employees of the Contractor and his Subcontractors shall be allowed on the Site except with the consent of the Engineer.

Facilities to inspect the Works shall at all times be afforded by the Contractor to the Engineer and his representatives, the Employer's representatives, authorities and officials.

Information for Import Permits and Licences 14.8 The Contractor shall submit to the Employer in good time such details of all Plant and Contractor's Equipment as will enable the Employer to obtain all necessary import permits or licences.

Compliance with Statutes, Regulations 15.1 The Contractor shall, in all matters arising in the performance of the Contract, comply in all respects with, give all notices and pay all fees required by the provisions of any national or state statute, ordinance or other law or any regulation or bye-law of any duly constituted authority.

Compliance with Laws 15.2 The Contractor shall comply with the laws of the country of manufacture concerning the manufacture of the Plant, and the laws of the country where the Plant is to be erected so far as such laws concern the manufacture, erection and operation of the Works.

Patent Rights 16.1 The Contractor shall indemnify the Employer against all claims of infringement of any patent, registered design, copyright, trade mark or trade name or other intellectual property right provided that all of following conditions are satisfied:

(a) The claim or proceedings arise out of the design, construction, manufacture or use of the Works or any Plant supplied by the Contractor.

(b) The right was protected at the date of the Contract in the Contractor's country or the country in which the Plant is to be manufactured or erected.

(c) The infringement or allegation of infringement was not caused by any use of the Works otherwise than for the purpose indicated by or reasonably to be inferred from the Specification.

(d) The infringement or allegation of infringement was not caused by the use of any Plant in association or combination with any plant not supplied by the Contractor, unless such association or combination was disclosed to the Contractor prior to the date of the Tender.

(e) The infringement or allegation of infringement was not caused by the Contractor following the design or instructions of the Employer or the Engineer.

Claims in respect of Patent Rights **16.2** The Contractor shall be promptly notified of any claim under this Clause made against the Employer. The Contractor may at his own cost conduct negotiations for the settlement of such claim, and any litigation that may arise therefrom.

The Employer shall not make any admission which might be prejudicial to the Contractor unless the Contractor has failed to take over the conduct of the negotiations or litigation within a reasonable time after having been so requested.

The Contractor may not, however, conduct such negotiations or litigation before he has given the Employer such reasonable security as the Employer may require. The security shall be for an amount which is an assessment of the compensation, damages, expenses and costs for which the Employer may become liable and which are the subject of the indemnity under Sub-Clause 16.1.

The Employer shall, at the request of the Contractor, provide all available assistance for the purpose of contesting any such claim or action, and shall be repaid all reasonable costs incurred in so doing.

Employer's Warranty for Patent Rights **16.3** If any matter for which the Contractor is not liable to indemnify the Employer under Sub-Clause 16.1 causes the infringement or allegation of infringement by the Contractor of any patent, registered design, trade mark, copyright or other intellectual property right, the Employer shall indemnify the Contractor against all claims, damages, expenses and costs which the Contractor may incur in relation thereto. The provisions of Sub-Clause 16.2 shall apply mutatis mutandis.

Obligations of the Employer

Access to and Possession of the Site **17.1** The Employer shall in reasonable time grant the Contractor access to and possession of the Site, which may, however, not be exclusive to the Contractor.

The Employer shall to the extent stated in the Specification provide means of access for the delivery of all Plant and Contractor's Equipment to the Site.

Assistance with Local Regulations **17.2** The Employer shall assist the Contractor in ascertaining the nature and extent of any laws, regulations, orders or bye-laws, and customs in the country where the Plant is to be erected, which may affect the Contractor in the performance of his obligations under the Contract. The Employer shall if so requested procure for the Contractor copies thereof and information relating thereto at the Contractor's cost.

Civil Works on Site **17.3** Any building, structure, foundation or means of access on the Site to be provided by the Employer shall be in a condition suitable for the reception, movement, installation and maintenance of the Works within the time or times indicated in the Programme.

Consents and Wayleaves **17.4** The Employer shall in due time obtain or grant all consents including permits-to-work, wayleaves and approvals required for the Works.

Import Permits and Licences **17.5** The Employer shall obtain all import permits or licences required for any part of the Plant or Works in reasonable time having regard to the time for delivery of the Plant and completion of the Works.

Labour

Engagement of Labour **18.1** The Contractor shall, unless otherwise provided in the Contract, make his own arrangements for the engagement of all labour and for their payment, housing, feeding and transport.

Returns of Labour **18.2** The Contractor shall submit detailed returns showing the supervisory staff and the numbers of the several classes of labour from time to time employed by the Contractor and Subcontractors on the Site. The returns shall be submitted in such form and at such intervals as the Engineer may prescribe.

Working Hours **18.3** On the Site the Contractor shall observe the normal working hours stated in the Preamble. The Employer shall allow the Contractor to carry out work on the Site continuously during such working hours.

The Engineer may after consulting the Employer and the Contractor, direct that work shall be done at other times. The extra cost, together with profit, shall be added to the Contract Price unless it has become necessary for the completion of the Works within the Time for Completion, and this is due to default of the Contractor.

Restriction on Working Hours **18.4** No work shall be carried out on the Site outside normal working hours or on the locally recognised days of rest, unless:

(a) the Contract so provides, or

(b) the work is unavoidable or necessary for the saving of life or property or for the safety of the Works, in which case the Contractor shall immediately advise the Engineer, or

(c) the Engineer gives his consent.

Workmanship and Materials

Manner of Execution **19.1** All Plant to be supplied shall be manufactured and all work to be done shall be executed in the manner set out in the Contract.

Where the manner of manufacture and execution is not set out in the Contract, the work shall be executed in a proper and workmanlike manner in accordance with recognised good practice.

Covering up Work **19.2** The Contractor shall give the Engineer full opportunity to examine, measure and test any work on Site which is about to be covered up or put out of view.

The Contractor shall give due notice to the Engineer whenever such work is ready for examination, measurement or testing.

The Engineer shall then, unless he notifies the Contractor that he considers it unnecessary, without unreasonable delay carry out the examination, measurement or testing.

Uncovering Work **19.3** If so instructed by the Engineer, the Contractor shall expose any parts of the Works. The Contractor shall reinstate and make good such parts to the Engineer's satisfaction.

If any parts of the Works have been covered up or put out of view by the Contractor after complying with Sub-Clause 19.2 and are found to be in accordance with the Contract the cost incurred by the Contractor in complying with the Engineer's instructions including profit shall be certified by the Engineer and added to the Contract Price.

Independent Inspection **20.1** The Engineer may, if so provided in the Contract or with the Contractor's consent, delegate inspection and testing of Plant to an independent inspector. Any such delegation shall be effected in the manner required by Sub-Clause 2.3, and for this purpose such independent inspector shall be considered as an Engineer's Representative. Notice of such appointment (being not less than 14 days) shall be given by the Engineer to the Contractor.

Inspection and Testing During Manufacture 20.2 The Engineer shall be entitled during manufacture to inspect, examine and test the materials and workmanship and check the progress of manufacture of all Plant to be supplied under the Contract. This shall take place on the Contractor's premises during working hours. If Plant is being manufactured on other premises, the Contractor shall obtain permission for the Engineer to carry out such inspection, examination and testing on those premises.

No such inspection, examination or testing shall release the Contractor from any obligation under the Contract.

Dates for Inspection and Testing 20.3 The Contractor shall agree with the Engineer the time and place for the testing of any Plant as provided in the Contract. The Engineer shall give the Contractor 24 hours notice of his intention to attend the tests.

If the Engineer does not attend on the date agreed, the Contractor may, unless the Engineer instructs the Contractor not to do so, proceed with the tests, which shall be deemed to have been made in the Engineer's presence.

The Contractor shall forthwith forward to the Engineer duly certified copies of the test results. If the Engineer has not attended the test, he shall accept the validity of the test readings.

Facilities for Testing 20.4 Where the Contract provides for tests on the premises of the Contractor or of any Sub-contractor, the Contractor shall provide such assistance, labour, materials, electricity, fuel, stores, apparatus and instruments as may be necessary to carry out the tests efficiently.

Certificate of Testing 20.5 When Plant has passed the tests referred to in this Clause, the Engineer shall furnish to the Contractor a certificate or endorse the Contractor's test certificate to that effect.

Rejection 21.1 If, as a result of the inspection, examination or testing referred to in Clause 20, the Engineer decides that any Plant is defective or otherwise not in accordance with the Contract, he may reject such Plant and shall notify the Contractor thereof immediately. The notice shall state the Engineer's objections with reasons. The Engineer shall not reject any Plant for minor defects which do not affect the commercial operation of such Plant.

The Contractor shall then with all speed make good the defect or ensure that any rejected Plant complies with the Contract.

If the Engineer requires such Plant to be retested, the tests shall be repeated under the same terms and conditions. All costs incurred by the Employer by the repetition of the tests shall be deducted from the Contract Price.

Permission to Deliver 22.1 The Contractor shall apply in writing to the Engineer for permission to deliver any Plant or Contractor's Equipment to the Site. No Plant or Contractor's Equipment may be delivered to the Site without the Engineer's written permission.

The Contractor shall be responsible for the reception on Site of the Plant and Contractor's Equipment.

Suspension of Works, Delivery or Erection

Order to Suspend 23.1 The Engineer may at any time instruct the Contractor to:

(a) suspend progress of the Works, or

(b) suspend delivery of Plant or Contractor's Equipment which is ready for delivery to the Site at the time for delivery specified in the Programme, or if no time is specified, at the time appropriate for it to be delivered, or

(c) suspend the erection of Plant which has been delivered to the Site.

When the Contractor is prevented from delivering or erecting Plant in accordance with the Programme the Engineer shall be deemed to have instructed a suspension except when such prevention is caused by the Contractor's default.

The Contractor shall during suspension protect and secure the Works or Plant affected at the Contractor's works or elsewhere or at the Site, as the case may be, against any deterioration, loss or damage.

Cost of Suspension **24.1** The additional cost incurred by the Contractor in protecting, securing and insuring the Works or Plant and in following the Engineer's instructions under Sub-Clause 23.1 and in resumption of the work, shall be added to the Contract Price.

The Contractor shall not be entitled to be paid any additional costs if such suspension is necessary by reason of a default on the part of the Contractor.

The Contractor shall not be entitled to additional costs unless he notifies the Engineer of his intention to make such claim, within 28 days after receipt of the order to suspend progress or delivery or of the date of deemed suspension under Sub-Clause 23.1.

Payment in Event of Suspension **24.2** The Contractor shall be entitled to payment for Plant which has not been delivered to Site if the work on Plant or delivery of Plant has been suspended for more than 28 days. After 28 days of suspension, the Contractor shall be entitled to payment of the value of such Plant as at the date of suspension.

A certificate of payment shall be issued on condition that:

(a) the Contractor has marked the Plant as the Employer's property in accordance with the Engineer's instructions, and

(b) the suspension is not due to the Contractor's default.

Prolonged Suspension **24.3** If suspension under Clause 23.1 has continued for more than 84 days, and the suspension is not due to the Contractor's default, the Contractor may by notice to the Engineer require permission to proceed within 28 days.

If permission is not granted within that time, the Contractor may treat the suspension as an omission under Clause 31 of the Section it affects, or if the suspension affects the whole of the Works, terminate the Contract and the provisions of Clause 46 shall apply.

Resumption of Work **24.4** If the Contractor chooses not to treat prolonged suspension as an omission or termination under Sub-Clause 24.3, the Employer shall upon the request of the Contractor, take over the responsibility for protection, storage, security and insurance of the suspended Works and the risk of loss or damage thereto shall thereupon pass to the Employer.

After receipt of permission or an order to proceed, the Contractor shall, after due notice to the Engineer, examine the Works and the Plant affected by the suspension. The Contractor shall make good any deterioration or defect in or loss of the Works or Plant that may have occurred during the suspension. Cost properly incurred by the Contractor which would not have been incurred but for the suspension shall be added to the Contract Price together with profit.

The Contractor shall not be entitled to payment for costs incurred in making good any deterioration, defect or loss caused by faulty workmanship or materials or by the Contractor's failure to take the measures specified in Sub-Clause 23.1.

If the Employer has taken over risk and responsibility for the suspended Works under this Sub-Clause, risk and responsibility shall revert to the Contractor 14 days after receipt of the permission or order to proceed.

Completion

Time for Completion **25.1** The Works shall be completed and shall have passed the Tests on Completion within the Time for Completion.

Extension of Time for Completion **26.1** The Contractor may claim an extension of the Time for Completion if he is or will be delayed in completing the Works by any of the following causes:

(a) extra or additional work ordered in writing under Clause 31,

(b) exceptional adverse weather conditions,

(c) physical obstructions or conditions which could not reasonably have been foreseen by the Contractor,

(d) Employer's or Engineer's instructions, otherwise than by reason of the Contractor's default,

(e) the failure of the Employer to fulfil any of his obligations under the Contract,

(f) delay by any other contractor engaged by the Employer,

(g) any suspension of the Works under Clause 23, except when due to the Contractor's default,

(h) any industrial dispute,

(i) the Employer's Risks.

(j) Force Majeure.

The Contractor shall give to the Engineer notice of his intention to make a claim for an extension of time within 14 days of the circumstances for such a claim becoming known to the Contractor. The notice shall be followed as soon as possible by the claim with full supporting details.

The Engineer shall, after due consultation with the Employer and the Contractor, grant the Contractor from time to time, either prospectively or retrospectively, such extension of Time for Completion as may be justified. The Engineer shall notify the Employer and the Contractor accordingly.

The Contractor shall be entitled to such extension whether the delay occurs before or after the Time for Completion.

Delays by Subcontractors **26.2** The Contractor shall be entitled to claim an extension of time if delay on the part of a Subcontractor is due to a cause mentioned in Clause 26.1, and such delay prevents the Contractor from meeting the Time for Completion.

Earlier Completion **26.3** The Employer may require completion of the Works or part thereof earlier than the Time for Completion, on the following conditions:

(a) The Employer and the Contractor shall first agree the extra sum to be paid for each day by which the Contractor completes the Works or part thereof earlier than the Time for Completion.

(b) The Contractor shall not become liable under Sub-Clause 27.1 for any failure to complete the Works or the part thereof by the earlier time.

Delay in Completion **27.1** If the Contractor fails to complete the Works within the Time for Completion, the Employer shall be entitled to a reduction in the Contract Price unless it can be reasonably concluded from the circumstances that the Employer will suffer no loss.

The Employer shall within a reasonable time give the Contractor notice of his intention to claim a reduction.

The reduction shall be the percentage per day stated in the Preamble of that part of the Contract Price which is attributable to such part of the Works as cannot in consequence of the failure be put to the intended use. The reduction shall be computed for each day between the Time for Completion and the actual date of completion.

The reduction shall in no case exceed the maximum percentage of the Contract Price of such part stated in the Preamble.

Except as provided in Sub-Clause 27.2, such reduction shall be to the exclusion of any other remedy of the Employer in respect of the Contractor's failure to complete within the Time for Completion.

Prolonged Delay **27.2** If the Employer has become entitled to the maximum reduction under Clause 27.1 for any part of the Works, he may by notice require the Contractor to complete. Such notice shall fix a final time for completion which shall be reasonable.

If the Contractor fails to complete within such time, and this is not due to a cause for which the Employer or some other contractor employed by him is responsible, the Employer may by further notice to the Contractor either:

(a) require the Contractor to complete, or

(b) may himself complete at the Contractor's cost provided that he does so in a reasonable manner, or

(c) terminate the Contract.

If the Employer terminates the Contract, he shall be entitled to recover from the Contractor any loss he has suffered up to the maximum amount stated in the Preamble. If no maximum amount is stated, the Employer shall not be entitled to recover more than that part of the Contract Price which is attributable to that part of the Works which cannot by reason of the Contractor's failure be put to the intended use.

The Employer shall give credit for the value of any part of the Works which he retains.

Tests on Completion

Notice of Tests **28.1** The Contractor shall give to the Engineer 21 day's notice of the date after which he will be ready to make the Tests on Completion (the Tests). Unless otherwise agreed, the Tests shall take place within 14 days after the said date on such day or days as the Engineer shall notify the Contractor.

Time for Tests **28.2** If the Engineer fails to appoint a time after having been asked to do so, or does not attend at the time and place appointed, the Contractor shall be entitled to proceed with the Tests in his absence. The Tests shall then be deemed to have been made in the presence of the Engineer and the results of the Tests shall be accepted as accurate.

Delayed Tests **28.3** If the Tests are being unduly delayed by the Contractor the Engineer may by notice require the Contractor to make the Tests within 21 days after the receipt of such notice. The Contractor shall make the Tests on such days within that period as the Contractor may fix and of which he shall give notice to the Engineer.

If the Contractor fails to make the Tests within 21 days the Engineer may himself proceed with the Tests. All Tests so made by the Engineer shall be at the risk and cost of the Contractor and the cost thereof shall be deducted from the Contract Price. The tests shall then be deemed to have been made in the presence of the Contractor and the results of the Tests shall be accepted as accurate.

Facilities for Tests on Completion **28.4** Except where otherwise specified, the Employer shall provide free of charge such labour, materials, electricity, fuel, water, stores, apparatus and feedstock as may be reasonably required by the Contractor to carry out the Tests.

Retesting **28.5** If the Works or any Section fails to pass the Tests, the Engineer or the Contractor may require such Tests to be repeated on the same terms and conditions. All costs to which the Employer may be put by the repetition of the Tests under this Sub-Clause or under Sub-Clause 30.7 shall be deducted from the Contract Price.

Disagreement as to Result of Tests **28.6** If the Engineer and the Contractor disagree on the interpretation of the Test results, each shall give a statement of his views to the other within 14 days after such disagreement arises. The statement shall be accompanied by all relevant evidence.

Consequences of Failure to Pass Tests on Completion **28.7** If the Works or any Section fails to pass the Tests on the repetition thereof under Sub-Clause 28.5, the Engineer, after due consultation with the Employer and the Contractor, shall be entitled to:

(a) order one further repetition of the Tests under the conditions of Sub-Clause 28.5, or

(b) reject the Works or Section in which event the Employer shall have the same remedies against the Contractor as are provided under Sub-Clause 30.5 (c), or

(c) issue a Taking-Over Certificate, if the Employer so wishes, notwithstanding that the Works are not complete. The Contract Price shall then be reduced by such amount as may be agreed by the Employer and the Contractor or, failing agreement, as may be determined by arbitration.

Use by the Employer **28.8** In considering the results of Tests carried out under Sub-Clauses 29.3, 29.4 and 30.7 the Engineer shall make allowances for the effect of any use of the Works by the Employer on the performance or other characteristics of the Works.

Test Certificate **28.9** As soon as the Works or any Section thereof has passed the Tests, the Engineer shall issue a Certificate to the Contractor and the Employer to that effect.

Taking Over

Taking Over **29.1** The Works shall be taken over by the Employer when they have been completed in accordance with the Contract, except in minor respects that do not affect the use of the Works for their intended purpose, have passed the Tests on Completion and a Taking-Over Certificate has been issued or deemed to have been issued in accordance with Sub-Clause 29.2.

Taking-Over Certificate **29.2** The Contractor may apply by notice to the Engineer for a Taking-Over Certificate not earlier than 14 days before the Works will in the Contractor's opinion be complete and ready for taking over under Sub-Clause 29.1.

The Engineer shall within 28 days after the receipt of the Contractor's application either:

(a) issue the Taking-Over Certificate to the Contractor with a copy to the Employer stating the date on which the Works were complete and ready for taking over, or

(b) reject the application giving his reasons and specifying the work required to be done by the Contractor to enable the Taking-Over Certificate to be issued.

If the Engineer fails either to issue the Taking-Over Certificate or to reject the Contractor's application within the period of 28 days he shall be deemed to have issued the Taking-Over Certificate on the last day of that period.

If the Works are divided by the Contract into Sections the Contractor shall be entitled to apply for separate Taking-Over Certificates for each such Section.

Use before Taking Over 29.3 The Employer shall not use any part of the Works unless a Taking-Over Certificate has been issued in respect thereof.

If nevertheless the Employer uses any part of the Works, that part which is used shall be deemed to have been taken over at the date of such use. The Engineer shall on request of the Contractor issue a Taking-Over Certificate accordingly. If the Employer uses any part of the Works before taking over the Contractor shall be given the earliest opportunity of taking such steps as may be necessary to carry out the Tests on Completion.

The provisions of Sub-Clause 27.1 shall not apply to any part of the Works while being so used by the Employer. Clause 30 shall apply as if the part had been taken over on the date it was taken into use.

Interference with Tests on Completion 29.4 If the Contractor is prevented from carrying out the Tests on Completion by a cause for which the Employer or the Engineer or other contractors employed by the Employer are responsible, the Employer shall be deemed to have taken over the Works on the date when the Tests on Completion would have been completed but for such prevention. The Engineer shall issue a Taking-Over Certificate accordingly.

The Works shall not be deemed to have been taken over if they are not substantially in accordance with the Contract.

If the Works are taken over under this Clause the Contractor shall nevertheless carry out the Tests on Completion during the Defects Liability Period. The Engineer shall require the Tests on Completion to be carried out by 14 days notice and in accordance with the relevant provisions of Clause 28.

Any additional costs to which the Contractor may be put in making the Tests on Completion during the Defects Liability Period, shall be added to the Contract Price.

Defects after Taking Over

Defects Liability Period 30.1 Where any part of the Works is taken over separately from the Works the Defects Liability Period for that part shall commence on the date it was taken over.

Making Good Defects 30.2 The Contractor shall, subject to Sub-Clause 30.9, be responsible for making good any defect in or damage to any part of the Works which may appear or occur during the Defects Liability Period and which arises from, either:

(a) any defective materials, workmanship or design, or

(b) any act or omission of the Contractor during the Defects Liability Period.

The Contractor shall make good the defect or damage as soon as practicable and at his own cost.

Notice of Defects 30.3 If any such defect appears or damage occurs, the Employer or the Engineer shall forthwith notify the Contractor thereof.

Extension of Defects Liability Period 30.4 The provisions of this Clause shall apply to all replacements or renewals carried out by the Contractor as if the replacements and renewals had been taken over on the date they were completed.

The Defects Liability Period for the Works shall be extended by a period equal to the period during which the Works cannot be used by reason of a defect or damage. If only part of the Works is affected the Defects Liability Period shall be extended only for that part.

In neither case shall the Defects Liability Period be extended by more than one year.

When erection or delivery of Plant has been suspended under Sub-Clause 23.1, the Contractor's obligations under this Clause shall not apply to any defects occurring more than three years after it would have been delivered but for the suspension or such period as may be stated in Part II.

Failure to Remedy Defects **30.5** If the Contractor fails to remedy a defect or damage within a reasonable time, the Employer may fix a final time for remedying the defect or damage.

If the Contractor fails to do so, the Employer may:

(a) carry out the work himself or by others at the Contractor's risk and cost, provided that he does so in a reasonable manner. The costs properly incurred by the Employer in remedying the defect or damage shall be deducted from the Contract Price, but the Contractor shall have no responsibility for such work, or

(b) require the Contractor to grant the Employer a reasonable reduction in the Contract Price to be agreed or fixed by arbitration under Clause 50, or

(c) if the defect or damage is such that the Employer has been deprived of substantially the whole of the benefit of the Works or a part thereof, he may terminate the Contract in respect of such parts of the Works as cannot be put to the intended use. The Employer shall to the exclusion of any remedy under Clause 45 be entitled to recover all sums paid in respect of such parts of the Works together with the cost of dismantling the same, clearing the Site and returning Plant to the Contractor or otherwise disposing of it in accordance with the Contractor's instructions.

Removal of Defective Work **30.6** If the defect or damage is such that repairs cannot be expeditiously carried out on the Site, the Contractor may with the consent of the Engineer or the Employer remove from the Site for the purposes of repair any part of the Works which is defective or damaged.

Further Tests on Completion **30.7** If the replacements or renewals are such that they may affect the performance of the Works, the Employer may request that Tests on Completion be repeated to the extent necessary. The request shall be made by notice within 28 days after the replacement or renewal. The Tests shall be carried out in accordance with Clause 28.

Right of Access **30.8** Until the Final Certificate of Payment has been issued, the Contractor shall have the right of access to all parts of the Works and to records of the working and performance of the Works.

Such right of access shall be during the Employer's normal working hours at the Contractor's risk and cost. Access shall also be granted to any duly authorised representative of the Contractor whose name has been communicated in writing to the Engineer.

Subject to the Engineer's approval, the Contractor may also at his own risk and cost make any tests which he considers desirable.

Defects in Employer's and Engineer's Designs **30.9** The Contractor shall not be liable for any defects resulting from designs furnished or specified by the Employer or the Engineer.

Contractor to Search **30.10** The Contractor shall, if required by the Engineer in writing, search for the cause of any defect, under the direction of the Engineer. Unless the defect is one for which the Contractor is liable under this Clause, the cost of the work carried out by the Contractor in searching for the cause of the defect shall be added to the Contract Price.

Defects Liability Certificate **30.11** When the Defects Liability Period for the Works or any part thereof has expired and the Contractor has fulfilled all his obligations under the Contract for defects in the Works or that part, the Engineer shall issue within 28 days to the Employer and the Contractor a Defects Liability Certificate to that effect.

Exclusive Remedies **30.12** Except in the case of Gross Misconduct, the Employer's remedies under this Clause shall be in place of and to the exclusion of any other remedy in relation to defects whatsoever.

Variations

Engineer's Right to Vary **31.1** The Engineer may by Variation Order to the Contractor at any time before the Works are taken over, instruct the Contractor to alter, amend, omit, add to or otherwise vary any part of the Works.

The Contractor shall not vary or alter any of the Works, except in accordance with a Variation Order from the Engineer. The Contractor may, however, at any time propose variations of the Works to the Engineer.

Variation Order Procedure **31.2** Prior to any Variation Order under Sub-Clause 31.1 the Engineer shall notify the Contractor of the nature and form of such variation.

As soon as possible after having received such notice, the Contractor shall submit to the Engineer:

(a) a description of work, if any, to be performed and a programme for its execution, and

(b) the Contractor's proposals for any necessary modifications to the Programme according to Sub-Clause 26.1 or to any of the Contractor's obligations under the Contract, and

(c) the Contractor's proposals for adjustment to the Contract Price.

Following the receipt of the Contractor's submission the Engineer shall, after due consultation with the Employer and the Contractor, decide as soon as possible whether or not the variation shall be carried out.

If the Engineer decides that the variation shall be carried out, he shall issue a Variation Order clearly identified as such in accordance with the Contractor's submission or as modified by agreement. If the Engineer and the Contractor are unable to agree the adjustment of the Contract Price, the provisions of Sub-Clause 31.3 shall apply.

Disagreement on Adjustment of the Contract Price **31.3** If the Contractor and the Engineer are unable to agree on the adjustment of the Contract Price, the adjustment shall be determined in accordance with the rates specified in the Schedule of Prices.

If the rates contained in the Schedule of Prices are not directly applicable to the specific work in question, suitable rates shall be established by the Engineer reflecting the level of pricing in the Schedule of Prices.

Where rates are not contained in the said Schedule, the amount shall be such as is in all the circumstances reasonable. Due account shall be taken of any over- or under-recovery of overheads by the Contractor in consequence of the variation.

The Contractor shall also be entitled to be paid:

(a) the cost of any partial execution of the Works rendered useless by any such variation, and

(b) the cost of making necessary alterations to Plant already manufactured or in the course of manufacture or of any work done that has to be altered in consequence of such a variation, and

(c) any additional costs incurred by the Contractor by the disruption of the progress of the Works as detailed in the Programme, and

(d) the net effect of the Contractor's finance costs, including interest, caused by the variation.

The Engineer shall on this basis determine the rates or prices to enable on-account payment to be included in certificates of payment.

Contractor to Proceed **31.4** On receipt of a Variation Order, the Contractor shall forthwith proceed to carry out the variation and be bound to these Conditions in so doing as if such variation was stated in the Contract.

The work shall not be delayed pending the granting of an extension of the Time for Completion or an adjustment to the Contract Price under Sub-Clause 31.3.

Records of Costs **31.5** In any case where the Contractor is instructed to proceed with a variation prior to the determination of the adjustment to the Contract Price in respect thereof the Contractor shall keep records of the cost of undertaking the variation and of time expended thereon. Such records shall be open to inspection by the Engineer at all reasonable times.

Ownership of Plant

Ownership of Plant **32.1** Plant to be supplied pursuant to the Contract shall become the property of the Employer at whichever is the earlier of the following times:

(a) when Plant is delivered to Site, or

(b) when by virtue of Sub-Clause 24.2 the Contractor becomes entitled to payment of the value of the Plant

Certificates and Payment

Terms of Payment **33.1** The terms of payment shall be as stated in the Preamble.

Method of Application **33.2** Unless otherwise specified in Part II applications by the Contractor for payment shall be made to the Engineer as follows:

(a) in respect of the progress of the Works accompanied by such evidence of the value of the work done as the Engineer may require, and

(b) in respect of Plant shipped and en route to the Site identifying the Plant concerned and accompanied by such evidence of shipment and of payment of freight and insurance and by such other documents as the Engineer may require, and

(c) for additional payment in accordance with Clause 34.

Any other application for payment shall state the amounts claimed and the detailed particulars in respect of which the application is made.

Issue of Certificate of Payment **33.3** Within 14 days after receiving an application for payment which the Contractor was entitled to make the Engineer shall issue a Certificate of Payment to the Employer showing the amount due, with a copy to the Contractor.

A certificate of payment, other than the Final Certificate of Payment, shall not be withheld on account of:

(a) defects of a minor character which are not such as to affect the use of the Works, or

(b) any part of the payment applied for being disputed. In such case a certificate of payment for the undisputed amount shall be issued.

Corrections to Certificates of Payment **33.4** The Engineer may in any certificate of payment make any correction or modification that should properly be made in respect of any previous certificate.

Payment **33.5** Unless otherwise specified in Part II, the Employer shall pay the amount certified within 28 days from the date of issue of each certificate of payment to the Contractor at his principal place of business.

Delayed Payment **33.6** If payment of any sum payable under Sub-Clause 33.5 is delayed, the Contractor shall be entitled to receive interest on the amount unpaid during the period of delay. Unless otherwise stated in Part II the interest shall be at the annual rate three percentage points above the discount rate of the central bank in the Contractor's country. The Contractor shall be entitled to such payment without formal notice and without prejudice to any other right or remedy.

Remedies on Failure to Certify or Make Payment **33.7** The Contractor shall be entitled to stop the Works by giving 14 days notice to the Engineer and the Employer, if either:

(a) the Engineer fails to issue a certificate of payment upon proper application by the Contractor, or

(b) the Employer fails to make any payment as provided in this Clause.

The cost to the Contractor together with profit occasioned by the stoppage and the subsequent resumption of work, shall be added to the Contract Price.

The Contractor shall also be entitled to terminate the Contract by giving 28 days notice to the Engineer and the Employer in any case where the Engineer has failed to issue a certificate of payment upon proper application by the Contractor.

Payment by Measurement **33.8** For any part of the Works which is to be paid according to quantity supplied or work done, the provisions for measurement shall be stated in Part II.

Application for Final Certificate of Payment **33.9** The Contractor shall make application to the Engineer for the Final Certificate of Payment within 28 days after the issue of the Defects Liability Certificate, or if more than one, the last Defects Liability Certificate.

The application for the Final Certificate of Payment shall be accompanied by a final account prepared by the Contractor. The final account shall give full details of the value of all Plant supplied and work done under the Contract together with:

(a) such additions to or deductions from the Contract Price as have been agreed, and

(b) all claims for additional payment to which the Contractor may consider himself entitled.

Issue of Final Certificate of Payment **33.10** The Engineer shall issue to the Employer with a copy to the Contractor, the Final Certificate of Payment within 28 days after receiving an application in accordance with Sub-Clause 33.9.

If the Contractor has not applied for a Final Certificate of Payment within the time specified in Sub-Clause 33.9 the Engineer shall request the Contractor to do so within a further period of 28 days. If the Contractor fails to make such an application, the Engineer shall issue the Final Certificate of Payment for such amount as he deems correct.

Final Certificate of Payment Conclusive **33.11** A Final Certificate of Payment shall be conclusive evidence of the value of the Works, that the Works are in accordance with the Contract and that the Contractor has performed all his obligations under the Contract.

Payment of the amount certified in the Final Certificate of Payment shall be conclusive evidence that the Employer has performed all his obligations under the Contract.

A Final Certificate of Payment or payment shall not be conclusive:

(a) to the extent that fraud or dishonesty relates to or affects any matter dealt with in the certificate, or

(b) if any arbitration or court proceedings under the Contract have been commenced by either party before the expiry of 84 days after the issue of the Final Certificate of Payment.

Claims

Procedure **34.1** In any case where under these Conditions there are circumstances which the Contractor considers entitle him to claim additional payment, the Contractor shall:

(a) if he intends to make any claim for additional payment give to the Engineer notice of his intention to make such claim within 28 days after the said circumstances became known to the Contractor stating the reasons for his claim, and

(b) as soon as reasonably practical after the date of such notice submit to the Engineer full and detailed particulars of his claim but not later than 182 days after such notice unless otherwise agreed by the Engineer. In any event such particulars shall be submitted no later than the application for the Final Certificate of Payment. The Contractor shall thereafter promptly submit such further particulars as the Engineer may reasonably require to assess the validity of the claim.

Assessment **34.2** When the Engineer has received full and detailed particulars of the Contractor's claim in accordance with Sub-Clause 34.1 and such further particulars as he may reasonably have required he shall after due consultation with the Employer and the Contractor determine whether the Contractor is entitled to additional payment and notify the parties accordingly.

The Engineer may reject any claim for additional payment which does not comply with the requirements of Sub-Clause 34.1.

Foreign Currency and Rates of Exchange

Payment in Foreign Currencies **35.1** Arrangements for payment in foreign currencies shall be as stated in the Preamble.

Currency Restrictions **35.2** The Employer shall reimburse the Contractor for any loss arising from:

(a) currency restrictions, and

(b) restrictions on the transfer of currency in which the Contractor is to be paid which are imposed by the government or authorised agency of the government of the country from which any payments under the Contract are to be made.

This Sub-Clause only applies to restrictions imposed after the date 28 days prior to the latest date for submission of tenders for the Works.

Rates of Exchange **35.3** Where the Contract provides for payment in Foreign Currency the rates of exchange between the currencies shall be fixed for the purpose of the Contract and shall be as stated in the Preamble.

If such rates of exchange are not stated in the Preamble the rates to be used shall be those quoted by the central bank of the country whose currency is to be sold 28 days or the nearest day thereto prior to the latest date for submission of tenders for the Works.

Provisional Sums

Use of Provisional Sums **36.1** A Provisional Sum shall only be used, in whole or in part in accordance with the Engineer's instructions.

The total sum paid to the Contractor shall include only such amounts in respect of work, supplies or services to which such Provisional Sums relate as the Engineer shall have instructed.

Ordering Work against Provisional Sums

36.2 In respect of every Provisional Sum the Engineer may after due consultation with the Employer and the Contractor order:

(a) work to be executed, including goods, materials or services to be supplied by the Contractor. The value of such work executed, determined in accordance with Clause 31, shall be paid to the Contractor in accordance with Clause 33, and

(b) goods and materials to be purchased by the Contractor, for which payment will be made in accordance with Sub-Clause 36.4.

Invoices and Receipts

36.3 The Contractor shall, when required by the Engineer, produce quotations, invoices, vouchers and accounts or receipts in connection with expenditure in respect of Provisional Sums.

Payment against Provisional Sums

36.4 For all work executed or goods, materials or services supplied or purchased by the Contractor under Sub-Clause 36.2 (b), there shall be included in the sums paid to the Contractor:

(a) the actual price paid or due to be paid by the Contractor, and

(b) in respect of all other charges and profit, a percentage of the actual price paid or due to be paid. Such percentage shall be as stated in the Preamble.

Risk and Responsibility

Allocation of Risk and Responsibility

37.1 The Risks of loss of or damage to physical property and of death and personal injury which arise in consequence of the performance of the Contract shall be allocated between the Employer and the Contractor as follows:

(a) the Employer: the Employer's Risks as specified in Sub-Clause 37.2

(b) the Contractor: the Contractor's Risks as specified in Sub-Clause 37.3.

Employer's Risks

37.2 The Employer's Risks are:

(a) war and hostilities (whether war be declared or not), invasion, act of foreign enemies;

(b) rebellion, revolution, insurrection, military or usurped power or civil war insofar as it relates to the country in which the Works are located or countries through which plant must be transported;

(c) ionising radiation or contamination by radio-activity from any nuclear fuel, or from any nuclear waste from the combustion of nuclear fuel, radio-active toxic explosives or other hazardous properties of any explosive nuclear assembly or nuclear components thereof;

(d) pressure waves caused by aircraft travelling at sonic or supersonic speed;

(e) riot, commotion or disorder, unless solely restricted to the employees of the Contractor or of his Subcontractors;

(f) use or occupation of the Works or any part thereof by the Employer;

(g) fault, error, defect or omission in the design of any part of the Works by the Engineer, Employer or those for whom the Employer is responsible;

(h) the use or occupation of the Site by the Works or any part thereof, or for the purposes of the Contract; or interference, whether temporary or permanent with any right of way, light, air or water or with any easement, wayleaves or right of a similar nature which is the inevitable result of the construction of the Works in accordance with the Contract;

(i) the right of the Employer to construct the Works or any part thereof on, over, under, in or through any land;

(j) damage (other than that resulting from the Contractor's method of construction) which is the inevitable result of the construction of the Works in accordance with the Contract;

(k) the act, neglect or omission or breach of contract or of statutory duty of the Engineer, the Employer or other contractors engaged by the Employer or of their respective employees or agents;

and all risks which an experienced contractor could not have foreseen or, if foreseeable, against which measures to prevent loss, damage or injury from occurring could not reasonably have been taken by such contractor.

Contractor's Risks **37.3** The Contractor's Risks are all risks other than those identified as the Employer's Risks.

Care of the Works and Passing of Risk

Contractor's Responsibility for the Care of the Works **38.1** The Contractor shall be responsible for the care of the Works or any Section thereof from the Commencement Date until the Risk Transfer Date applicable thereto under Sub-Clause 38.2.

The Contractor shall also be responsible for the care of any part of the Works upon which any outstanding work is being performed by the Contractor during the Defects Liability Period until completion of such outstanding work.

Risk Transfer Date **38.2** The Risk Transfer Date in relation to the Works or a Section thereof is the earliest of either:

(a) the date of issue of the Taking-Over Certificate, or

(b) the date when the Engineer is deemed to have issued the Taking-Over Certificate or the Works are deemed to have been taken over in accordance with Clause 29, or

(c) the date of expiry of the notice of termination when the Contract is terminated by the Employer or the Contractor in accordance with these Conditions.

Passing of Risk of Loss of or Damage to the Works **39.1** The risk of loss of or damage to the Works or any Section thereof shall pass from the Contractor to the Employer on the Risk Transfer Date applicable thereto.

Loss or Damage Before Risk Transfer Date **39.2** Loss of or damage to the Works or any Section thereof occurring before the Risk Transfer Date shall:

(a) to the extent caused by any of the Contractor's Risks, be made good forthwith by the Contractor at his own cost, and

(b) to the extent caused by any of the Employer's Risks, be made good by the Contractor at the Employer's expense if so required by the Engineer within 28 days after the occurrence of the loss or damage. The price for making good such loss and damage shall be in all circumstances reasonable and shall be agreed by the Employer and the Contractor, or in the absence of agreement, shall be fixed by arbitration under Clause 50.

Loss or Damage After Risk Transfer Date **39.3** After the Risk Transfer Date, the Contractor's liability in respect of loss of or damage to any part of the Works shall, except in the case of Gross Misconduct, be limited:

(a) to the fulfillment of the Contractor's obligations under Clause 30 in respect of defects therein, and

(b) to making good forthwith loss or damage caused by the Contractor during the Defects Liability Period.

Damage to Property and Injury to Persons

Contractor's Liability **40.1** Except as provided under Sub-Clause 41.1, the Contractor shall be liable for and shall indemnify the Employer against all losses, expenses and claims in respect of any loss of or damage to physical property (other than the Works), death or personal injury occurring before the issue of the last Defects Liability Certificate to the extent caused by:

(a) defective design, material or workmanship of the Contractor, or

(b) negligence or breach of statutory duty of the Contractor, his Subcontractors or their respective employees and agents.

Employer's Liability **40.2** The Employer shall be liable for and shall indemnify the Contractor against all losses, expenses or claims in respect of loss of or damage to any physical property or of death or personal injury whenever occurring, to the extent caused by any of the Employer's Risks.

Accidents **41.1** The Contractor shall be liable for and shall indemnify the Employer against all losses, expenses or claims arising in connection with the death of or injury to any person employed by the Contractor or his Subcontractors for the purposes of the Works, unless caused by any acts or defaults of the Engineer, the Employer or other contractors engaged by the Employer or by their respective employees or agents. In the latter cases the Employer shall be liable for and shall indemnify the Contractor against all losses, expenses and claims arising in connection therewith.

Limitations of Liability

Liability for Indirect or Consequential Damage **42.1** Neither party shall be liable to the other for any loss of profit, loss of use, loss of production, loss of contracts or for any other indirect or consequential damage that may be suffered by the other, except:

(a) as expressly provided in Clause 27, and

(b) those provisions of these Conditions whereby the Contractor is expressly entitled to receive profit.

Maximum Liability **42.2** The liability of the Contractor to the Employer under these Conditions shall in no case exceed the sum stated in the Preamble or, if no such sum is stated, the Contract Price.

Liability after Expiration of Defects Liability Period **42.3** The Contractor shall have no liability to the Employer for any loss of or damage to the Employer's physical property which occurs after the expiration of the Defects Liability Period unless caused by Gross Misconduct of the Contractor.

Exclusive Remedies **42.4** The Employer and the Contractor intend that their respective rights, obligations and liabilities as provided for in these Conditions shall alone govern their rights under the Contract and in relation to the Works.

Accordingly, the remedies provided under the contract in respect of or in consequence of:

(a) any breach of contract, or

(b) any negligent act or omission, or

(c) death or personal injury, or

(d) loss or damage to any property

are, save in the case of Gross Misconduct, to be to the exclusion of any other remedy that either may have against the other under the law governing the Contract or otherwise.

Mitigation of Loss or Damage **42.5** In all cases the party claiming a breach of Contract or a right to be indemnified in accordance with the Contract shall be obliged to take all reasonable measures to mitigate the loss or damage which has occurred or may occur.

Foreseen Damages **42.6** Where either the Employer or the Contractor is liable in damages to the other these shall not exceed the damage which the party in default could reasonably have foreseen at the date of the Contract.

Insurance

The Works **43.1** The Contractor shall insure the Works in the joint names of the Contractor and the Employer to their full replacement value with deductible limits not exceeding those stated in the Preamble.

(a) from the Commencement Date until the Risk Transfer Date against any loss or damage caused by any of the Contractor's Risks and any other risks specified in the Preamble, and

(b) during the Defects Liability period against any loss or damage which is caused either:

(i) by the Contractor in completing any outstanding work or complying with his obligations under Clause 30, or

(ii) by any of the Contractor's Risks which occurred prior to the Risk Transfer Date.

Contractor's Equipment **43.2** The Contractor shall insure Contractor's Equipment for its full replacement value whilst in transit to the Site, from commencement of loading until completion of unloading at the Site and while on the Site against all loss or damage caused by any of the Contractor's Risks.

Third Party Liability **43.3** The Contractor shall insure against liability to third parties for any death or personal injury and loss of or damage to any physical property arising out of the performance of the Contract and occurring before the issue of the last Defects Liability Certificate.

Such insurance shall be effected before the Contractor begins any work on the Site. The insurance shall be for not less than the amount specified in the Preamble.

Employees **43.4** The contractor shall insure and maintain insurance against his liability under Sub-Clause 41.1.

General Requirements of Insurance Policies **43.5** The Contractor shall:

(a) whenever required by the Employer produce the policies or certificates of any insurance which he is required to effect under the Contract together with receipts for the premiums,

(b) effect all insurances for which he is responsible with an insurer and in terms approved by the Employer, and

(c) make no material alterations to the terms of any insurance without the Employer's approval. If an insurer makes any material alteration to the terms the Contractor shall forthwith notify the Employer, and

(d) in all respects comply with any conditions stipulated in the insurance policies which he is required to place under the Contract.

Permitted Exclusions from Insurance Policies **43.6** The insurance cover effected by the Contractor may exclude any of the following:

(a) the cost of making good any part of the Works which is defective or otherwise does not comply with the Contract provided that it does not exclude the cost of making good any loss or damage to any other part of the Works attributable to such defect or non-compliance,

(b) indirect or consequential loss or damage including any reductions in the Contract Price for delay,

(c) wear and tear, shortages and theft,

(d) risks relating to vehicles for which third party or other insurance is required by law.

Remedies on the Contractor's Failure to Insure **43.7** If the Contractor fails to produce evidence of insurance cover as stated in Sub-Clause 43.5. (a) then the Employer may effect and keep in force such insurance. Premiums paid by the Employer for this purpose shall be deducted from the Contract Price.

Amounts not Recovered **43.8** Any amounts not recovered from the insurers shall be borne by the Employer or Contractor in accordance with their responsibilities under Clause 37.

Force Majeure

Definition of Force Majeure **44.1** Force Majeure means any circumstances beyond the control of the parties, including but not limited to:

(a) war and other hostilities, (whether war be declared or not), invasion, act of foreign enemies, mobilisation, requisition or embargo;

(b) ionising radiation or contamination by radio-activity from any nuclear fuel or from any nuclear waste from the combustion of nuclear fuel, radio-active toxic explosives, or other hazardous properties of any explosive nuclear assembly or nuclear components thereof;

(c) rebellion, revolution, insurrection, military or usurped power and civil war;

(d) riot, commotion or disorder, except where solely restricted to employees of the Contractor.

Effect of Force Majeure **44.2** Neither party shall be considered to be in default or in breach of his obligations under the Contract to the extent that performance of such obligations is prevented by any circumstances of Force Majeure which arise after the date of the Letter of Acceptance or the date when the Contract becomes effective, whichever is the earlier.

Notice of Occurrence **44.3** If either party considers that any circumstances of Force Majeure have occurred which may affect performance of his obligations he shall promptly notify the other party and the Engineer thereof.

Performance to Continue **44.4** Upon the occurrence of any circumstances of Force Majeure the Contractor shall endeavour to continue to perform his obligations under the Contract so far as reasonably practicable. The Contractor shall notify the Engineer of the steps he proposes to take including any reasonable alternative means for performance which is not prevented by Force Majeure. The Contractor shall not take any such steps unless directed so to do by the Engineer.

Additional Costs caused by Force Majeure **44.5** If the Contractor incurs additional costs in complying with the Engineer's directions under Sub-Clause 44.4, the amount thereof shall be certified by the Engineer and added to the Contract Price.

Damage Caused by Force Majeure **44.6** If in consequence of Force Majeure the Works shall suffer loss or damage the Contractor shall be entitled to have the value of the work done, without regard to the loss or damage that has occurred, included in a Certificate of Payment.

Termination in Consequence of Force Majeure **44.7** If circumstances of Force Majeure have occurred and shall continue for a period of 182 days then, notwithstanding that the Contractor may by reason thereof have been granted an extension of Time for Completion of the Works, either party shall be entitled to serve upon the other 28 days' notice to terminate the Contract. If at the expiry of the period of 28 days Force Majeure shall still continue the Contract shall terminate.

Payment on Termination for Force Majeure **44.8** If the Contract is terminated under Sub-Clause 44.7 the contractor shall be paid the value of the work done.

The Contractor shall also be entitled to receive:

(a) the amounts payable in respect of any preliminary items so far as the work or service comprised therein has been carried out and a proper proportion of any such item in which the work or service comprised has only been partially carried out,

(b) the cost of materials or goods ordered for the Works or for use in connection with the Works which have been delivered to the Contractor or of which the Contractor is legally liable to accept delivery. Such materials or goods shall become the property of and be at the risk of the Employer when paid for by the Employer and the Contractor shall place the same at the Employer's disposal,

(c) the amount of any other expenditure which in the circumstances was reasonably incurred by the Contractor in the expectation of completing the whole of the Works,

(d) the reasonable cost of removal of Contractor's Equipment from the Site and the return thereof to the Contractor's works in his country or to any other destination at no greater cost, and

(e) the reasonable cost of repatriation of the Contractor's staff and workmen employed wholly in connection with the Works at the date of such termination.

Release from Performance **44.9** If circumstances of Force Majeure occur and in consequence thereof under the law governing the Contract the parties are released from further performance of the Contract, the sum payable by the Employer to the Contractor shall be the same as that which would have been payable under Sub-Clause 44.8 if the Contract had been terminated under Sub-Clause 44.7.

Force Majeure Affecting Engineer's Duties **44.10** The provisions of Clause 44 shall also apply in circumstances where the Engineer is prevented from performing any of his duties under the Contract by reason of Force Majeure.

Default

Notice of Default **45.1** If the Contractor is not executing the Works in accordance with the Contract or is neglecting to perform his obligations thereunder so as seriously to affect the carrying out of the Works, the Engineer may give notice to the Contractor requiring him to make good such failure or neglect.

Contractor's Default **45.2** If the Contractor:

(a) has failed to comply within a reasonable time with a notice under Sub-Clause 45.1, or

(b) assigns the Contract or subcontracts the whole of the Works without the Employer's written consent, or

(c) becomes bankrupt or insolvent, has a receiving order made against him or compounds with his creditors, or carries on business under a receiver, trustee or manager for the benefit of his creditors or goes into liquidation,

the Employer may, after having given 7 days notice to the Contractor, terminate the Contract and expel the Contractor from the Site.

Any such expulsion and termination shall be without prejudice to any other rights or powers of the Employer, the Engineer or the Contractor under the Contract.

The Employer may upon such termination complete the Works himself or by any other contractor.

Valuation at Date of Termination **45.3** The Engineer shall, as soon as possible after such termination, certify the value of the Works and all sums then due to the Contractor as at the date of termination in accordance with Clause 33.

Payment after Termination **45.4** The Employer shall not be liable to make any further payments to the Contractor until the Works have been completed. When the Works are so complete, the Employers shall be entitled to recover from the Contractor the extra costs, if any, of completing the Works after allowing for any sum due to the Contractor under Sub-Clause 45.3. If there is no such extra cost the Employer shall pay any balance due to the Contractor.

Effect on Liability for Delay **45.5** The Contractor's liability under Clause 27 shall immediately cease when the Employer expels him from the Site without prejudice to any liability thereunder that may have already occurred.

Employer's Default **46.1** The Contractor may, by giving 14 days notice to the Employer and the Engineer, terminate the Contract if the Employer:

(a) fails to pay the Contractor the amount due under any certificate of the Engineer within 28 days after the amount became payable, or

(b) interferes with or obstructs the issue of any certificate of the Engineer, or

(c) becomes bankrupt or insolvent, has a receiving order made against him, compounds with his creditors, or carries on business under a receiver, trustee or manager for the benefit of his creditors or goes into liquidation, or

(d) consistently fails to meet his contractual obligations, or

(e) appoints a person to act with or in replacement of the Engineer without the Contractor's consent.

Any such termination shall be without prejudice to any other rights of the Contractor under the Contract.

Removal of Contractor's Equipment **46.2** On such termination, the Contractor shall be entitled to remove immediately all Contractor's Equipment which is on the Site.

Payment on Termination for Employer's Default **46.3** In the event of such termination the Employer shall pay the Contractor an amount calculated in accordance with Sub-Clause 44.8.

The Employer shall pay in addition the amount of any loss or damage, including loss of profit which the Contractor may have suffered in consequence of termination. The additional amount shall, however, not exceed the limit specified in the Preamble.

Changes in Cost and Legislation

Labour, Materials and Transport **47.1** Where the Contract Price is to be adjusted for changes in the cost of labour, materials, transport or other costs of execution of the Works, the method for calculating such adjustment shall be specified in the Preamble.

When calculating the adjustment no account shall be taken of any increased cost which results from the Contractor's default or negligence.

Statutory and Other Regulations **47.2** The Contract Price shall be adjusted to take account of any increase or decrease in cost resulting from changes in legislation of the country where the Site is located or in its generally accepted interpretation.

Legislation means any law, order, regulation or bye-law having the force of law, which affects the Contractor in the performance of his obligations under the Contract, made after the date 28 days prior to the latest date for submission of tenders for the Works.

The Engineer shall certify the amount of the resulting increase or decrease in cost, which shall be added to or deducted from the Contract Price.

Customs

Customs and Import Duties **48.1** Unless otherwise stated in Part II the Employer shall pay all customs, import duties and taxes in consequence of the importation of Plant. If the Contractor is required to pay such customs, import duties and taxes, the Employer shall reimburse the amount thereof.

Clearance through Customs **48.2** The Employer shall assist the Contractor in obtaining clearance through the customs of all Plant and Contractor's Equipment and in procuring any necessary government consent to the re-export of Contractor's Equipment when it is removed from the Site.

Notices

Notices to Contractor **49.1** All certificates, notices or written orders to be given to the Contractor by the Employer or the Engineer under these Conditions shall be sent by airmail post, cable, telex or facsimile transmission to or left at the Contractor's principal place of business or such other address as the Contractor shall nominate for that purpose, or may be handed over to the Contractor's representative.

Notices to Employer and Engineer **49.2** Any notice to be given to the Employer or to the Engineer under these Conditions shall be sent by airmail post, cable, telex or facsimile transmission to or left at the respective addresses nominated for that purpose in the Preamble, or handed over to the Engineer's or the Employer's representative authorised to receive it.

Minutes of Meetings **49.3** Instructions or notices to the Contractor and notices from the Contractor to the Engineer or the Employer recorded in a minute or protocol signed by the authorized representatives of the giver and recipient of such notice or instruction shall be valid notice or instruction for the purposes of the Contract.

Disputes and Arbitration

Disputes concerning Engineer's Decisions **50.1** If either party is dissatisfied with a decision or instruction of the Engineer as confirmed, reversed or varied in accordance with Clause 2 he may refer the matter to arbitration pursuant to Sub-Clause 50.2.

Unless the dissatisfied party has notified the other party and the Engineer within 56 days of such decision or instruction of his intention to refer the matter to arbitration, he shall be deemed to have accepted the decision as final.

Reference to arbitration shall not relieve the Contractor of his obligation to proceed with the Works in accordance with the Engineer's decision or instruction, nor relieve the Employer of any of his obligations under the Contract.

The Contractor shall in any such arbitration be at liberty to rely on reasons additional to the reasons stated in the notice given under Sub-Clause 2.7.

Arbitration **50.2** If at any time any question, dispute or difference shall arise between the Employer and the Contractor in connection with or arising out of the Contract or the carrying out of the Works either party shall be entitled to refer the matter to be finally settled by arbitration in accordance with the Rules of Conciliation and Arbitration of the International Chamber of Commerce by one or more arbitrators appointed in accordance with those Rules, or by arbitration in accordance with such other rules as are specified in Part II.

The Arbitrator(s) shall have full power to open up, review and revise:

(a) any decision or instruction of the Engineer referred to arbitration pursuant to Sub-Clause 50.1, and

(b) any certificate of the Engineer related to the dispute.

Works to Continue **50.3** Performance of the Contract shall continue during arbitration proceedings unless the Employer shall order suspension. If any such suspension is ordered the reasonable costs incurred by the Contractor and occasioned thereby shall be added to the Contract Price.

No payments due or payable by the Employer shall be withheld on account of pending reference to arbitration.

Time Limit for Arbitration **50.4** Formal notice of arbitration must be given to the other party, and where required to the appropriate arbitration body, no later than 84 days after the issue of the Final Certificate of Payment.

Law and Procedure

Applicable Law **51.1** The law which is to apply to the Contract and under which the Contract is to be construed is stated in the Preamble.

Procedural Law **51.2** The law governing the procedure and administration of any arbitration instituted pursuant to Clause 50 is stated in the Preamble.

Language **51.3** The language and place of the arbitration are stated in the Preamble.

PART II SPECIAL CONDITIONS

(The Clauses referred to in Part II — Section A are those where the provision in the General Conditions (Part I) refer to an alternative solution to be stated in Part II. The provisions in the General Conditions will apply unless an alternative solution is given in Part II — Section A. The clauses in this section need therefore not be completed, but must be completed if alternative solutions to the relevant Part I provisions are necessary.)

Section A

Conditions Precedent to Commencement

Sub-Clause 1.1.1.

The following financial and administrative requirements are conditions precedent to commencement:

_____

_____

Defects Liability Period

Sub-Clause 1.1.11.

The Defects Liability Period is _____ days.

Engineer's Duties

Sub-Clause 2.1.

The Engineer requires the consent of the Employer before exercising the following duties:

_____

_____

Operation and Maintenance Manuals

Sub-Clause 6.6.

Operation and Maintenance Manuals shall be in the _____ language.

Manufacturing Drawings

Sub-Clause 6.9.

The Contractor is required to disclose to the Engineer or the Employer confidential information as follows:

_____

_____

General Obligations

Sub-Clause 8.1.

The following facilities will be provided by the Employer:

_____

_____

The facilities will be provided at the following rates:

_____

_____

Performance Security

Sub-Clause 10.1.

The Contractor shall obtain a Performance Security of an amount

of _____.

Contractor's Equipment

Sub-Clause 14.1.

The following items of Contractor's Equipment will be provided free of charge by the Employer for the Contractor's use:

_____

_____

Extention of Defects Liability Period

Sub-Clause 30.4.

In the event of suspension the Defects Liability Period shall not last more than ___ days after the date the Plant would have been delivered but for the suspension.

Method of Application

Sub-Clause 33.2.

Application for payment shall be made as follows:

_____

_____

Payment

Sub-Clause 33.5.

The period for payment shall be:

_____

The place for payment shall be:

_____

Delayed Payment

Sub-Clause 33.6.

The interest rate for delayed payment is _____ %.

Payment by Measurement

Sub-Clause 33.8.

The provisions for measurement are:

_____

_____

Customs and Import Duties

Sub-Clause 48.1.

The Contractor shall pay and be reimbursed by the Employer for the following customs, import duties and taxes in consequence of the importation of the Plant:

_____

_____

Arbitration

Sub-Clause 50.2.

The rules of arbitration shall be those of:

_____

Section B

Add further Special Conditions as may be required for the particular project.

INDEX

Index

Index

Index

Index

Index

Index

Tender

NAME OF CONTRACT: _____

_____

TENDER

TO: _____

_____

_____

1. Having examined the Tender Documents including the Instructions to Tenderers, Conditions of Contract, Specification, Employer's Drawings and Schedule of Prices for the execution of the above-named Contract, we, the undersigned, hereby offer to execute, complete and remedy defects in the whole of the Works in conformity with the said documents for the sum of

   _____

   _____

   (_____)

2. We undertake, if our Tender is accepted, to complete and deliver the whole of the Works comprised in the Contract within the time or times stated in the Contract, subject to the said Conditions.

3. We agree to abide by this Tender for a period of _____ days from the date fixed for receiving the same and it shall remain binding upon us and may be accepted by you at any time before the expiration of that period.

4. This Tender is submitted under our covering letter

   reference _____ dated _____ and the completed tender documents and other information, required by the Instructions to Tenderers, which are enclosed therewith all of which shall be read and construed as forming a part hereof.

5. This Tender, together with your written acceptance thereof shall constitute a binding Contract between us, valid from the date of your written Letter of Acceptance.

6. We understand that you are not bound to accept the lowest or any Tender you may receive.

   Dated this _____ day of _____ 19 __

   Signature _____ in the capacity of _____

   duly authorised to sign tenders for and on behalf of:

   Witness _____

   Address _____

   _____

   Occupation _____

Contract Agreement

This Agreement made the _____ day of _____ 19 ___

Between _____

_____

_____ (hereinafter called "the Employer") and

_____

_____ (hereinafter called "the Contractor")

Whereas the Employer requires that certain Works should be provided and executed by the Contractor, namely _____

_____

and has appointed _____ as the Engineer for the purposes thereof and has accepted a Tender by the Contractor for the provision and execution of such Works in the sum of _____

_____

_____

_____ (hereinafter called "the Contract Price").

Now it is agreed as follows:

1. In this Agreement words and expressions shall have the meanings as are respectively assigned to them in the Conditions of Contract hereinafter referred to.

2. The following documents shall be deemed to form this Agreement:

   (a) The Letter of Acceptance
   (b) The Preamble
   (c) The Conditions of Contract Part II
   (d) The Conditions of Contract Part I
   (e) The Specification
   (f) The Schedules
   (g) The Employer's Drawings
   (h) The Contractor's Drawings
   (i) The Tender.

3. The Contractor shall provide execute and complete the Works and remedy defects therein in conformity in all respects with the provisions of the Contract.

4. The Employer shall pay the Contractor in consideration of the provision execution and completion of the Works and the remedying of defects therein the Contract Price or such other sum as may become payable under the provisions of the Contract at the times and in the manner prescribed by the Contract.

5. The parties have entered into this Agreement in accordance with their respective laws and statutes or constitutions on the date hereof by their duly authorised signatories.

Signature(s) on behalf of the Employer _____

_____

Signature(s) on behalf of the Contractor _____

_____

EDITORIAL AMENDMENTS

Following publication of the Third Edition of the Conditions of Contract for Electrical and Mechanical Works in 1987, a number of editorial amendments were agreed by FIDIC. The amendments have been incorporated during reprinting and the list below clarifies the differences between this copy and the original document.

Page 1 — The following additional text has been inserted:

Commencement Date — Sub-Clause 1.1.1.(i)
The date for commencement of the Works is_____

Page 2 — Sub-Clause 36.4(b) was previously Sub-Clause 36.4
The word 'Sums' following 'shall be' has been deleted.

Page 8 — Sub-Clause 2.7. The missing letter 'D' has been inserted in 'Disputing' (margin note.)

Page 33 — Sub-Clause 44.8(b). The word 'Contractor' on the last line was previously 'Contract'.

Page 35 — Sub-Clause 49.3. The word 'or' between 'minute' and 'protocol' was previously 'of'.

Index, page (i) — The words 'Adverse physical conditions and artificial obstructions' have been deleted.

Index, page (v) — The word 'adverse' has been deleted after 'Physical conditions'.

Contract Agreement — The word 'Agreement' in the title has been capitalised.

Line 4 — Inverted commas have been inserted after 'Employer'.

Line 6 — Inverted commas have been inserted before the word 'the' and deleted before the word 'Contractor'.

Line 7 — The comma following the word 'executed' has been deleted.

Line 15 — Inverted commas have been inserted before the word 'the' and deleted after the word 'the'.

Item 4, line 2 — The word 'defects' was previously 'defect'.

Item 4, line 3 — The word 'become' was previously 'be come'.

Item 5, line 1 — The words 'and statutes or constitutions' have been inserted after the word 'laws'.

Item 5, line 2 — The words 'by their duly authorized signatories' have been inserted after the word 'hereof'.

Item 5 — The remaining text of the original document has been deleted and is replaced by:
'Binding Signatures(s) on behalf of the Employer _____'
and
'Binding Signatures(s) on behalf of the Contractor _____'

PREAMBLE

The Employer	Sub-Clause 1.1.12. The Employer is Bhutan Power Corporation Limited (BPC), Renewable Energy Division.
The Engineer	Sub-Clause 1.1.15. The Engineer is as appointed by BPC for the works.
Time for Completion	Sub-Clause 1.1.35. Time for Completion is 5 months from the date handing over of the site.
Contractor's Profit	Sub-Clause 1.6 The percentage to cover profit entitlement, where appropriate, is 20% (maximum). Separate % is not admissible. The percentage profit shall be inclusive along with overheads, and all other charges.
Ruling Language	Sub-Clause 5.1. The version in English language (ruling language) shall prevail.
Day to Day Communications	Sub-Clause 5.2. The language for day to day communications is English.
Program to be Furnished	Sub-Clause 12.1. The program must be submitted in the form of MS Project.
Electricity, Water, Gas and Other Services	Sub-Clause 14.3. The Contractor shall make his own arrangements for the required services related to electricity including extension of temporary lines, internal wiring, water, stores from relevant authorities. BPC shall provide liasioning assistance only. All the costs incurred against these services shall be borne by the Contractor.
Employer's Equipment	Sub-Clause 14.4. The Following Employer's equipment is available for use by the Contractor under the Employer's operation: The clause is not applicable. The Contractor shall make his own arrangements for all the related equipments required for the project.
Working Hours	Sub-Clause 18.3. It shall be as per the Labor Laws of Bhutan. Also refer Conditions of Contract Part II Special Conditions
Delay in Completion	Sub-Clause 27.1. Failure to meet the Time for Completion entitles the Employer to reduction in Contract Price as follows: Refer Special Conditions of Contract.

Prolonged Delay	Sub-Clause 27.2. Maximum amount recoverable from the Contractor by the Employer: Not stated and will be recovered as detailed in Clause 27.2.
Terms of Payment	Sub-Clause 33.1. The terms of payment shall be as indicated in Conditions of Contract Part II Special Conditions. The time of payment shall be within 30 days from the date of submission of bills and proper documents as mentioned in clause 33.1 and 33.2 of the special conditions.
Payment in Foreign Currencies	Sub-Clause 35.1. Payment in foreign currencies shall be arranged as follows: For items with price quoted in US Dollars (for third country supplies), the equivalent Bhutanese Ngultrum payment would be made based on the exchange rate (at Bills Selling Rates of Exchange published by the Royal Monetary Authority of Bhutan) on the date of release of such payment. Bhutanese Ngultrum and Indian Rupees is at par.
Rates of Exchange	Sub-Clause 35.3. The rates of exchange for the purpose of the Contract are: For items with price quoted in US Dollars (for third country supplies), the equivalent Bhutanese Ngultrum payment would be made based on the exchange rate (at Bills Selling Rates of Exchange published by the Royal Monetary Authority of Bhutan) on the date of release of such payment. *Bhutanese Ngultrum and Indian Rupees is at par.
Payment against Provisional Sums	Sub-Clause 36.4. The percentage to be applied to Provisional Sums shall be Sums. Clause is not applicable.
Maximum Liability	Sub-Clause 42.2. The maximum liability of the Contractor to the Employer shall be: Contract Price.
Insurance of Works	Sub-Clause 43.1. The deductible limit in the insurance cover of the Works shall not exceed: Deductible limit is not applicable. The Contractor shall insure the works to cover full amount. Sub-Clause 43.1. (a) The additional risks to be insured are: Nil.

Third Party Liability	Sub-Clause 43.3. The minimum insurance amounts and deductibles shall be: As per "All Risk Policy" from any of the National Insurance Companies and shall cover loss of or damages to the works, plants and materials to be built into the work
Payment on Termination for Employer's Default	Sub-Clause 46.3. The additional amount payable by the Employer on termination shall not exceed: Clause is not applicable.
Labour, Materials and Transport	Sub-Clause 47.1. Clause is not applicable.
Notices to Employer and Engineer	Sub-Clause 49.2. The addresses of the Employer for notice are: Manager, Renewable Energy Division, Distribution Construction Department, Bhutan Power Corporation Limited, Yarden Lam, PO Box No. 580, Thimphu, Bhutan. Contact (M): +975 - 17670073 Email : pema_wangchuk@bpc.bt
Applicable Law	Sub-Clause 51.1. The Contract shall be interpreted in accordance with the laws of: Kingdom of Bhutan.
Procedural Law for Arbitration	Sub-Clause 51.2. The procedural law for arbitration is as per prevalent laws in Bhutan.
Language and Place of Arbitration	Sub-Clause 51.3. The language of arbitration is English language. The place of arbitration is Thimphu, Bhutan.

Section 1C – Special Conditions of Contract (SCC)

SECTION 1C

CONDITIONS OF CONTRACT

PART II – SPECIAL CONDITIONS OF CONTRACT

Notes on the Special Conditions of Contract

(The Clause referred to in Part II are those where the provision in the General Conditions (Part I i.e Section 1B) refer to an alternative solution to be stated in Part II. The provisions in the GCC will apply unless an alternative solution is given in Part II. The clauses in this section need therefore not be completed, but must be completed if alternative solutions to the relevant Part I provision are necessary).

SPECIAL CONDITIONS

Sub Clause 1.1.1 Conditions Precedent to Commencement	Item ii) to v) are not applicable.
Sub Clause 1.1.11 Defects Liability Period	The defects liability period shall be one year from the date of proper taking over of the Works and not from the date of commissioning of the Power Plants.
Sub-Clause 5.3 Priority of Contract Documents	Delete the documents listed 1 –5 and substitute: 1. The Contract Agreement; 2. Integrity Pact; 3. The Letter of Acceptance; 4. The Preamble 5. Amendments 6. The Conditions of Contract Part II (Section 1C); 7. The Conditions of Contract (FIDIC- E&M Works) Part I (Section 1B) 8. The specifications. 9. Any other documents forming part of the Contract In case of conflict, if any, in Clauses of 1 to 9 above, the decision and interpretation of the contract by the Employer shall be final.
Sub Clause 6.6 Operation & Maintenance Manuals	Operation and Maintenance manuals shall be in English language.
Sub Clause 6.9 Manufacturing Drawings	The Contractor is required to disclose to the Engineer or the Employer confidential information such as manufacturing defects noticed in the equipment after installation at other Works site, decisions such as termination of product within ten (10) years of supply of the product etc.
Sub-Clause 7.2 Errors by Employer or Engineer	Clause is not applicable for this bid.
Sub-Clause 8.1 Contractor's General Responsibilities	The Employer shall not provide any facilities to the Contractor at the Work site. The Contractor shall make his own arrangements with respect to the same. The Employer shall provide assistance for obtaining necessary clearances etc. However, all the related expenses shall be borne by the Contractor.

Sub-Clause 10.1 Performance Security

Replace the text of Sub-Clause 10.1 with the following:

"The Contractor shall provide security for his proper performance of the Contract to the Employer within 7 days after the receipt of the Letter of Acceptance. The performance security shall be for 10% of the Contract Amount and shall be in the form of a bank guarantee, issued either (a) by a bank located in Bhutan or a foreign bank through a correspondent bank located in Bhutan or (b) directly by a foreign bank acceptable to the Employer. When providing such security to the Employer, the Contractor shall also notify the Engineer.

Without limitation to the provisions of the preceding paragraph, whenever the Engineer determines an addition to the Contract Price as a result of a change in cost and/or legislation or as a result of a variation amounting to more than 25 percent of the portion of the Contract Price payable in a specific currency, the Contractor, at the Engineer's written request, shall promptly increase the value of the performance security in that currency by an equal percentage.

The cost of complying with the requirements of this Clause shall be borne by the Contractor."

Sub-Clause 12.1 Program to be Furnished

"The time within which the program shall be submitted shall be ten (10) days."

Sub Clause 14.1 Contractor's Equipment

The Contractor shall provide all the equipment necessary to complete the works.

Sub-Clause 18.3 Working Hours

The second para. shall be modified as follows:

"Subject to any provision contained in the Contract, the Contractor shall have the option to work by day and by night after obtaining prior permission of the Employer, Ministry of Home Affairs, Police and Ministry of Labour. However, under any circumstances extra claim(s) towards the same will not be entertained."

Sub-Clause 20.4 Facilities for Testing

Following shall be added at the end of para.

'The Contractor shall also bear the cost towards conveyance (to & fro) of the Employer's/Engineer's representative from the nearest railway station / airport to manufacturer's works and local transport during the inspection trips and meetings.'

Sub-Clause 22.1 Permission to Delivery	'Engineer' shall be replaced by 'Employer'
Sub-Clause 25.1 Time for Completion	Time for completion shall be five (5) months from the date of contract signing.
Sub-Clause 26.1 Extension of Time for Completion	Following shall be added as: 'Contractors shall not be entitled for claims of establishment charges, day to day operation cost, hiring of vehicle, salaries of employees etc. for the extended period of stay and ideal labor charges arising out off any circumstances. Such expenses are deemed to be included in Contractor's Risks.'
Sub-Clause 27.1 Delay in Completion	Add / modify as follows: "The liquidated damages for the whole of the Works are 0.1% of the final contract price per day. The maximum amount of liquidated damages for the whole of the Works is 10% of the Final Contract Price."
Sub-Clause 30.4 Extension of Defects Liability	The last para. of the Sub- Clause shall be deleted and modified as follows: "When progress in respect of Plant has been suspended under Sub-Clause 23.1, the Contractor's obligations under this Clause shall not apply to any defects occurring more than one year after the Time for Completion established on the date of the Letter of Acceptance."
Sub Clause 30.9 Defects in Employer's and Engineer's Designs	Clause is not applicable for this bid.
Sub-Clause 31.3 Adjustment of the Contract Price	Delete the Clause and add the following: "If the Contractor and the Engineer are unable to agree on the adjustment of the Contract price, the adjustment shall be determined in accordance with the rates specified in the Schedule of Prices. If the rates contained in the Schedules are not directly applicable to the specific work in question, suitable rates shall be established by the Engineer reflecting the level of pricing in the Schedule of Prices. Where the rates are not contained in the said Schedule, the amount shall be such as is in all the circumstances reasonable. Else the rates shall be derived based on joint

observation of cost shall be recorded and payment shall be made on the basis of quotation or the actual invoices from the manufacturer, actual taxes and duties, transportation charges and 20% on ex-works towards Contractors overheads.

Clause 33

Clause 33 of the General Conditions shall be deleted and the following Sub- Clauses 33.1 to 33.16 are substituted therefore:

Sub-Clause 33.1 Terms of Payment Equipment

Payment for supply of equipment will be made as under:

a) 10 % advance pursuant to Sub Clause 33.9 below.

b) 80% Payment against delivery of equipment/materials as covered in Bill of Quantities of the Contract. The invoice for claiming 80% payment should be accompanied by the following documents.

i. Proof of delivery: Submission of entry proof in Bhutan duly certified by the Revenue & Customs Department.
ii. Contractor's detailed invoice giving full particulars of the equipment/material, status of supplies, payment received (format shall be obtained from Employer).
iii. Detailed packing list.
iv. Inspection reports and Test Certificates.
v. Certificates of BST/Taxes paid in and outside Bhutan.
vi. Certification of excise duty payment in and outside Bhutan.
vii. Physical verification and certification by Engineer at work site.
viii. Submission of Monthly Progress report
ix. BST shall be reimbursed separately based on the submission of original receipts (refer sub clause 48.1 and 52.3)
x. Three copies of invoices and above document shall be submitted for the claims.

c) Balance 10% Payment: After the "Taking over" of the Works and issue of Performance Certificate by the Employer's representative and submission of Bank Guarantee by the Contractor of equivalent amount to cover defect liability period.

Sub-Clause 33.2 Terms of payment For Installation and Other Services

Payment for installation and Erection of Equipment, will be made as under:

a) 10 % advance pursuant to Sub Clause 33.9 below.

b) 80% Payment upto an extent of 80% of contract value would be made periodically in each quarter on presentation of installation, erection and repair & maintenance invoice giving full details of the work done and joint measurements during the quarter along with updated statement showing the status of payments due and received against receipt of monthly progress reports. Three copies of invoices and joint measurements sheets shall be submitted for the claims.

c) Balance: 10%: Payment would be released on successful commissioning and "Taking Over" of the works and issue of Performance Certificate by the Employer's Representative and submission of Bank Guarantee by the Contractor of an equivalent amount to cover the defect liability period.

Sub-Clause 33.3 Quarterly Statement

The Contractor shall submit a statement in three (3) copies to the Engineer at the end of each quarter, in a tabulated form approved by the Engineer, showing the amounts to which the Contractor considers himself to be entitled. The statement shall include the following items, as applicable, which shall be taken into account in the sequence listed:

a) the estimated contract value of the Temporary and Permanent Works executed up to the end of the quarter in question, at base unit rates and prices and in bid currency;

b) the actual value certified for payment for the Temporary and Permanent Works executed up to the end of the previous quarter, at base unit rates and prices and in bid currency;

c) the estimated contract value at base unit rates and prices of the Temporary and Permanent Works for the quarter in question, in bid currency, obtained by deducting (b) from (a);

d) the value of any variations executed up to the end of the quarter in question, less the amount certified in the previous Interim Payment Certificate, pursuant to Clause 31.3;

e) any amount to be withheld under the retention provisions of Sub-Clause 33.7, determined by applying the percentage set forth in Sub-Clause 33.7 due under paragraphs 33.3 (d).

f) any amounts to be deducted as repayment of the Advance under the provisions of Sub-Clause 33.9; and

g) Any other sum, to which the Contractor may be entitled under the Contract.

Sub-Clause 33.4 Quarterly Payment

a) The said statement shall be approved or amended by the Engineer/Employer in such a way that, in his opinion, it reflects the amounts due to the Contractor in accordance with the Contract, after deduction, other than pursuant to Clause 27.1, of any sums which may have become due and payable by the Contractor to the Employer. In cases where there is a difference of opinion as to the value of any item, the Engineer's view shall prevail. Within 28 days of receipt of the quarterly statement referred to in Sub - Clause 33.3, Engineer shall determine the amounts due to the Contractor and shall issue to the Employer and the Contractor a certificate herein called "Interim Payment Certificate", certifying the amounts due to the Contractor.

Notwithstanding the terms of this Clause or any other Clause of the Contract, no amount will be certified by the Engineer for payment, until the performance security has been provided by the Contractor and approved by the Employer.

Sub-Clause 33.6 Place of Payment

Payment to the contractor by the employer shall be made in the currency in which the Contract Price is payable, into a bank account or accounts nominated by the contractor. All bank charges towards effecting the payment to the Contractor as above, including but not limited to Bank charges for preparation of draft/ cheque and / or transfer shall be at the cost of the Contractor.

Sub-Clause 33.7 Retention Money

A retention amounting to 10 (ten) percent of the amounts due in each currency, determined in accordance with the procedure set out in Sub-Clause 33.3 shall be made by the Engineer in the first and following Interim Payment Certificates.

Sub-Clause 33.8 Payment of Retention Money

Upon the expiration of the Defects Liability Period for the Works, the Retention Money shall be certified by the Engineer for payment to the Contractor. Provided that, in the event of different Defects Liability Periods being applicable to different Sections or parts of the Permanent Works pursuant to Clause 29.2, the expression "expiration of the Defects Liability Period" shall, for the purposes of this Sub-Clause, be deemed to mean the expiration of the latest of such periods.
Provided also that if at such time, there shall remain to be executed by the Contractor any work instructed, pursuant to Clauses 30.1 and 30.10, in respect of the Works, the Engineer shall be entitled to withhold certification until completion of such work of so much of the balance of the Retention Money as shall, in the opinion of the Engineer, represent the cost of the work remaining to be executed.

Sub-Clause 33.9 Advance Payment

a) The Employer will make an interest-free advance payment to the Contractor exclusively for the costs of mobilization in respect of the Works in an amount equivalent to 10 percent of the Contract Price named in the Letter of Acceptance. Payment of such advance amount will be due under separate certification by the Engineer after (i) execution of the Form of Agreement by the parties hereto; (ii) provision by the Contractor of the performance security in accordance with Sub-Clause 10.1; and (iii) provision by the Contractor of an unconditional bank guarantee in a form and by a bank acceptable to the Employer in amount equal to the advance payment. Such bank guarantee shall remain effective until the advance payment has been repaid pursuant to paragraph (b) below, but the amount thereof shall be progressively reduced by the amount repaid by the Contractor as indicated in Interim Payment Certificates issued in accordance with this Clause.
The payment shall be released after following conditions are met:

a. Site office setup with a provision of Guesthouse.
b. Appointment of Project Manager and his presence at site.
c. Mobilization of construction equipment and materials.
d. Mobilization of adequate laborers for immediate activities.

b) The advance payment shall be repaid through

percentage deductions from the interim payments certified by the Engineer in accordance with the Clause. Deductions shall commence in the first Interim Payment Certificate, and shall be made at the rate of 10 percent of the amount of all Interim Payment Certificates in the currency of the advance payment until such time as the advance payment has been repaid; always provided that the advance payment shall be completely repaid prior to the time when 80 percent of the Contract Price has been certified for payment.

Sub-Clause 33.10 Time of Payment and Interest

The amount due to the Contractor under any Interim Payment Certificate issued by the Engineer pursuant to this Clause, or to any other term of the Contract, shall subject to Clause 27.1, be paid by the Employer to the Contractor within 30 days after the receipt of bill and invoices along with joint measurement sheets and Contractor's quarterly statement by the Engineer for certification or, in the case of the Final Certificate pursuant to Sub-Clause 33.13, within 40 days after the agreed Final Statement and written discharge have been submitted to the Engineer for certification.

Sub-Clause 33.11 Correction of Certificates

The Engineer may by any Interim Payment Certificate make any correction or modification in any previous Interim Payment Certificates which has been issued by him, and shall have authority, if any work is not being carried out to his satisfaction, to omit or reduce the value for such work in any Interim Payment Certificate.

Sub-Clause 33.12 Statement of Completion

Not later than 40 days after the issue of the Taking-Over Certification in respect of the whole of the Works, the Contractor shall submit to the Engineer six copies of Statement of Completion with supporting documents showing in detail, in the form approved by the Engineer.

a) The final value of all work done in accordance with the Contract upto the date stated in such Taking-Over Certificate;
b) Any further sums which the Contractor considers to be due; and
c) An estimate of amounts, which the Contractor considers, will become due to him under the Contract.

The estimated amounts shall be shown separately in such Statement of Completion. The Engineer shall certify

payment in accordance with Sub-Clause 33.4.

Sub-Clause 33.13 Final Statement

Not later than 56 days after the issue of the Defects Liability Certificate pursuant to Sub-Clause 30.11, the Contractor shall submit to the Engineer for consideration six copies of a draft final statement with supporting documents showing in detail, in the form approved by the Engineer,

a) The value of all work done in accordance with the Contract; and

b) Any further sums which the Contractor considers to be due to him under the Contract or otherwise.

If the Engineer disagrees with or cannot verify any part of the draft final statement, the Contractor shall submit such further information as the Engineer may reasonably require and shall make such changes in the draft as may be agreed between them. The Contractor shall then prepare and submit to the Engineer the final statement as agreed (for the purposes of these Conditions referred to as the "Final Statement").

If, following discussions between the Engineer and the Contractor and any changes to the draft final statement which may be agreed between them, it becomes evident that a dispute exists, the Engineer shall issue to the Employer an Interim Payment Certificate for those parts of the draft final statement which are not in dispute. The dispute shall then be settled in accordance with Clause 50. The Final Statement shall bear agreed upon settlement of the dispute.

Sub-Clause 33.14 Discharge

Upon submission of the Final Statement, the Contractor shall give to the Employer, with a copy to the Engineer, a written discharge confirming that the total of the Final Statement represents full and final settlement of all money due to the Contractor arising out of or in respect of the Contract. Provided that such discharge shall become effective only after payment due under the Final Payment Certificate issued pursuant to Sub-Clause 33.15 has been made and the performance security referred to in Sub-Clause 10.1 has been returned to the Contractor.

Sub-Clause 33.15 Final Payment Certificate

Within 40 days after receipt of the Final Statement and the written discharge, the Engineer shall issue to the Employer (with a copy to the Contractor) a Final Payment Certificate stating

a) the amount which, in the opinion of the Engineer, is finally due under the Contract or otherwise, and

b) After giving credit to the Employer for all amounts previously paid by the Employer and for all sums to which the Employer is entitled, other than Clause 27.1, the balance, if any, due from the Employer to the Contractor or from the Contractor to the Employer as the case may be.

Sub-Clause 33.16 Cessation of Employer's Liability

The Employer shall not be liable to the Contractor for any matter or thing arising out of or in connection with the Contract or execution of the Works, unless the Contractor shall have included a claim in respect thereof in his Final Statement and (except in respect of matters or things arising after the issue of the Taking-Over Certificate in respect of the whole of the Works) in the Statement of Completion referred to in Sub-Clause 33.12.

Sub-Clause 37.2 Employer's Risks

Sub-Clause 37.2 g) shall be deleted.

Sub-Clause 40.1 Contractor's Liability

Add the following words at the end of sub-Clause 40.1:
Any damages caused due to contract works should be reinstated to its normal condition after the completion of the work.

Sub-Clause 43.1 and 43.2 Insurance The Works and Contractor's Equipment

Add the following words at the end of Sub-Clause 43.1 and 43.2:

", it being understood that such insurance shall provide for compensation to be payable in currency of bid required to rectify the loss or damage incurred." The Contractor has to ensure that insurance coverage for the project is made through a recognized and authorized insurance company acceptable to the Employer.

Sub-Clause 43.6 Permitted Exclusions from Insurance Policies

Sub-clause 43.6 is amended to read as follows:

"There shall be no obligation for the insurances in Sub-Clause 43.1 to include loss or damage caused by the risks listed under Sub-Clause 43.6 paras. a) to d)".

Sub Clause 46.1 Employer's Default

Sub Clause 46.1 e) is deleted.

Sub-Clause 48.1 Taxes and Duty

Delete the Clause and add the following:

'The Contractor shall be responsible for payment of all taxes, duties, levies, royalties, etc., as applicable in and outside Bhutan and shall be included in FAS price.'

ADDITIONAL CLAUSES

Clause 52
Taxation

Sub-Clause 52.1
Foreign Taxation

The prices bid by the Contractor shall include all taxes, duties and other charges imposed outside the Employer's country on the production, manufacture, sale and transport of the Contractor's Equipment, Plant, materials and supplies to be used on or furnished under the Contract, and on the services performed under the Contract.

Sub-Clause 52.2
Local Taxation

The prices bid by the Contractor shall include all duties, import duties, business taxes, income and other taxes that may be levied in accordance to the laws and regulations in being as of the date 28 days prior to the closing date for submission of bids in the Employer's country on the Contractor's Equipment, Plant, materials and supplies (permanent, temporary and consumable) acquired for the purpose of the Contract and on the services performed under the Contract. Nothing in the Contract shall relieve the Contractor from his responsibility to pay any tax that may be levied in the Employer's country on profits made by him in respect of the Contract.

Sub-Clause 52.3
Custom Duty &
Bhutan Sales Tax

The Contractor shall be responsible for payment of all levies, royalty, taxes, etc. as applicable in Bhutan. Bhutan Sales Tax (BST) and Customs Duty are applicable at the entry check post. The applicable BST/CD rates as ascertained by the Contractor from the relevant authorities before submission of Bids and indicated in the offer would be the limiting value for reimbursement of the BST/CD. The payment towards BST/CD will be made by BPC at actual against proof of payment at the check post subject to ceiling of the value quoted by the Bidder against various items. However, in the event there is any change in BST/CD rates during the period of 15 days prior to the deadline for submission of Bids till scheduled completion (delays in Contract execution, which are attributable to Contractor will not be considered for payment towards any additional BST/CD) due to Royal Government of Bhutan (RGOB) regulations, the difference in the official rates (between the original applicable rates and the revised rates) will be considered for additional payment.

The Contractor shall procure the materials required for the civil works such as cement, steel, steel rods etc. within Bhutan. However, in case if it is found necessary to procure materials from outside Bhutan, an indent shall have to be made by the Contractor and presented to Employer's Representative which will be examined and cleared for purchase by the Employer/

Engineer before initiating procurement process by the Contractor.

The Contractor will have to pay the BST and Customs Duty at the entry check post and submit the following documents for reimbursement claims to Employer's Representative.

a) Original money receipt of Revenue and Customs Divisions.

b) Original source vendor invoice/ bill/ cash memo of the materials for which BST & Customs Duty is paid as reflected in the above receipt duly stamped by Custom authorities in Bhutan.

In case of misuse of the permit/material, suitable penal deduction shall be made from the Contractor's bill upto 5 times the BST leviable on such materials.

On completion of works, if it is observed that excess goods/ materials have been procured by the Contractor, the BST/ Customs Duty reimbursed to the Contractor in case of these materials will have to be refunded to the Employer by the Contractor. These excess goods/ materials will be assessed based on the consumption statement entered in the Books of Measurement (MBs).

Sub-Clause 52.4 Business Income Tax & Foreign Contractor Tax

The Contractor will have to pay Business Income Tax in Bhutan. Presently, the applicable Contractor Tax (FCT) is 3% for non-nationals and 2% for Bhutanese Contractors. This will be deducted from the gross amount of the bills/ invoices.

Sub-Clause 52.5 Income Tax on Staff

The Contractor's staff, personnel and labor will be liable to pay Personal Income Tax in Bhutan in respect of such of their salaries and wages as are chargeable under the laws and regulations for the time being in force, and the Contractor shall perform such duties in regard to such deductions thereof as may be imposed on him by such laws and regulations.

Clause 53
Bribes

If the Contractor, or any of his Subcontractors, agents or servants gives or offers to give to any person any bribe, gift, gratuity or commission as an inducement or reward for doing or forbearing to do any action in relation to the Contract or any other contract with the Employer, or for showing or forbearing to show favor or disfavor to any person in relation to the Contract or to any other contract with the Employer, then the Employer may enter upon the Site and the Works and expel the Contractor and the provisions of Clause 45.4 hereof shall apply as if such entry and expulsion had been made pursuant to that Clause.

Clause 54
Termination of Contract for Employer's Convenience

54.1 The Employer shall be entitled to terminate this Contract at any time for the Employer's convenience after giving 56 days' prior notice to the Contractor, with a copy to the Engineer. In the event of such termination, the Contractor

a) shall proceed as provided in Sub-Clause 46.2; and

b) shall be paid by the Employer as provided in Sub-Clause 45.3

54.2 The employer shall have the right at its sole discretion to terminate or cancel the contract in whole or in-part of the following events by giving 30 days' prior notice:

a) If employer deems that the work or a part of the work thereof cannot be completed by the contractor within the period or extended period provided by the contract on account of any reason which is attributable to the contractor.
b) The contractor, without reasonable excuse has failed to commence the work according to the agreed work schedule specified in the contract.
c) The contractor is not executing the work in accordance with the orders and/or instructions of Employer and is persistently and flagrantly neglecting to carryout his obligations under the contract, or
d) The contractor has acted unlawfully in the performance of the contract, or
e) The contractor has become bankrupt or insolvent.

In the event BPC terminates or cancels the contract in whole or in part, BPC may after giving 14 days prior notice in writing enter the site of the work and the contractor shall not obstruct BPC's action.

In the event BPC shall make entrance or cause the contractor to withdraw from the work site in accordance with the contract, BPC shall have no responsibility under the contract for payment to the contractor until the work is completed and the

expenses incurred for completion of the works, the amount of damages for delay in completion and any other expenses borne by BPC have been ascertained.

The contractor shall be obligated to pay to BPC the amount required by BPC or other contractors for additional costs of installation and administration resulting from non-fulfillment of the contract by the contractor and the damages for breach of contract by the contractor.

Clause 55
Joint and Several Liability

If the Contractor is a joint venture of two or more persons, all such persons shall be jointly and severally liable to the Employer for the fulfillment of the terms of the Contract and shall designate one of such persons to act as a leader with authority to bind the joint venture. The composition or the constitution of the joint venture shall not be altered without the prior consent of the Employer.

Clause 56
Details to be Confidential

The Contractor shall treat the details of the Contract as private and confidential, save insofar as may be necessary for the purposes thereof, and shall not publish or disclose the same or any particulars thereof in any trade or technical paper or elsewhere without the previous consent in writing of the Employer or the Engineer. If any dispute arises as to the necessity of any publication or disclosure for the purpose of the Contract the same shall be referred to the decision of the Employer whose award shall be final.

BHUTAN POWER CORPORATION LIMITED

(An ISO 9001:2015, ISO 14001:2015&OHSAS 18001:2007 Certified Company)

Distribution Construction Department
Renewable Energy Division
Thimphu: Bhutan

Bidding Document

For

Supply, Install, Testing and Commissioning of 180kW Grid-Tied Ground-Mounted Solar Power Project at Rubessa under Wangdue Phodrang District, Bhutan

Identification No. 08/BPC/RED/DCD/2020/Vol-1/46 Dt.07/09/2020

Volume I Part-2 – Technical Requirements

September 2020

PART - 2

TECHNICAL REQUIREMENTS

CONTENTS

Section 2A – General Technical Requirement (GTR)

SECTION 2A: GENERAL TECHNICAL REQUIREMENTS (GTR)

TABLE OF CONTENT

PART 2A – GENERAL TECHNICAL REQUIREMENTS

1.1. Project Information

This project is part of a global UNDP project geared towards covid-19 response and recovery with a theme "Innovation for a Smarter, Greener & more Resilient 21st Century Bhutan."

The overall objective of the project is to contribute to the following development plans of the Royal Government of Bhutan (RGoB)

i. NKRA 2: Economic diversity and productive capacity enhanced
ii. NKRA 6: Carbon neutral, climate and disaster resilient development enhanced

The outcomes of the project are

i. Demonstrate the feasibility and viability of utility scale grid connected Solar PV technology
ii. Promote Solar PV as alternative energy source to optimize, diversify the energy supply mix of the country and enhance the energy security of the country
iii. Enhance institutional capacity on solar PV technologies

The project will install 180 kW grid connected solar PV plant at Rubessa under Wangduephodrang district adjacent to the existing 600kW Wind Power Plant.

Physical and Other Parameters

Location of the Solar Power Generation Project is indicated below:

SN	Name of Project	Name of Country	Nearest Airport
1.	180kW Grid-Tied Ground-Mounted Solar PV Project at Rubessa, Wangdue Phodrang	Bhutan	Paro International Airport in Bhutan. Bagdogra and Guwahati airports in India.

Meteorological Data

Geographical Coordinates : Lat: 27.468^0N & Lon: 89.90255^0E
Altitude : Less than 1350 m
Ambient Temperature : Min 5 deg. C, Max 27 deg. C
Average annual rainfall : 748 mm
Climate : Varied from tropical to cold winters
Relative humidity : 20-100%

1.2. Scope of Work: Design, Manufacturing & Supply

The Scope of work for supply covered under this specification shall be as under: -

1.2.1. Solar Photovoltaic Modules

The 180 kW solar PV plant shall comprise of 522 numbers of 345Wp of poly crystalline type.

The module type must be qualified as per IEC 61215 latest edition. SPV module conversion efficiency should be equal to or greater than 17% under STC and AM 1.5 radiations. Modules must qualify to IEC 61730 Part I and II for safety qualification testing. Certificate for module qualification from IEC or equivalent shall be submitted as part of the bid offer. Self-undertaking from manufacturer / supplier that the modules being supplied are as per above.

The PV module shall perform satisfactorily in humidity up to 100% with temperature between - 3 ^{o}C to + 40 ^{o}C. Since the modules would be used in a high voltage circuit, the high voltage insulation test shall be carried out on each module and a test certificate to that effect provided.

The predicted electrical degradation at the end of the period of 10 years shall be less than ten (10) per cent of the full rated original output.

Manufacturers / suppliers should confirm whether they are supplying PV module using a RF identification tag (RFID), which must contain the following information. The RFID can be inside or outside the module laminate, but must be able to withstand harsh environmental conditions.

(i) Name of the manufacturer of PV Module
(ii) Name of the Manufacturer of Solar cells
(iii) Month and year of the manufacture (separately for solar cells and module)
(iv) Country of origin (separately for solar cells and module)
(v) I-V curve for the module
(vi) Peak Wattage, Im, Vm and FF for the module
(vii) Unique Serial No and Model No of the module
(viii) Date and year of obtaining IEC PV module qualification certificate
(ix) Name of the test lab issuing IEC certificate
(x) Other relevant information on traceability of solar cells and module as per ISO 9000 series.

1.5 Other general requirement for the PV modules and subsystems shall be the following:

(i) The peak-power point voltage and the peak-power point current of any supplied module and/or any module string (series connected modules) shall not vary more than 3 (three) percent from the respective arithmetic means for all modules and/or for all module strings, as the case may be.
(ii) Except where specified, the front module surface shall consist of impact resistant, low-iron and high-transmission toughened glass.
(iii) The module frame, if any, shall be made of a corrosion-resistant material which shall be electrolytic ally compatible with the structural material used for mounting the modules.
(iv) The module shall be provided with a junction box with either provision of external screw terminal connection or sealed type and with arrangement for provision of by-pass diode. The box shall have hinged, weather proof lid with captive screws and cable gland entry points or may be of sealed type and IP65 rated.

1.2.2. Mounting Structure

The contractor shall refer civil drawings and BoQ for the construction details of the mounting structures.

1.2.3. String Combiner Box

The string combiner boxes are to be provided in the PV array for termination of connecting cables. The combiner box shall be made of GRP/FRP/Powder Coated Aluminum /cast aluminum alloy with full dust, water & vermin proof arrangement. All wires/cables must be terminated through cable lugs. The combiner box shall be such that input & output termination can be made through suitable cable glands.

Copper bus bars/terminal blocks housed in the combiner box with suitable termination threads Conforming to IP65 standard or better and IEC 62208 Hinged door with EPDM rubber gasket to prevent water entry. Single compression cable glands. Provision of earthings. It should be placed at appropriate height for easy accessibility.

The connection and shall comply as per the technical specifications and drawings provided.

Each combiner box shall have High quality Suitable Capacity Metal Oxide Varistors (MOVs) / surge arrestors, suitable Reverse Blocking Diodes. The combiner boxes shall have suitable arrangement monitoring and disconnection for each of the groups.

Suitable markings shall be provided on the bus bar for easy identification and the cable ferrules must be fitted at the cable termination points for identification

1.2.4. LV/415Volts AC Distribution Panel Board (ACDB)

AC Distribution Panel Board shall control the AC power from inverter, and should have necessary surge arrestors. Interconnection from ACDB to mains at LT Bus bar to be carried out and complete equipment. Requirement/specifications of ACDB may be changed as per site conditions. An ACDB to be provided at the cable terminating point emanating from inverter for interconnection control of dedicated electrical loads. All switches at the, circuit breakers, connectors should confirm to IEC 0947, part I, II and III.
The LV ACBD shall be installed outdoor and shall have an enclosure with IP65 or better protection degree. The construction and arrangement of LV ACDB to be followed as per the electrical drawing and technical specifications provided.

1.2.5. String Inverter

The string inverter power rating and numbers shall be as same as that of that mentioned in Technical Specification and electrical drawings.

The inverter shall continuously control the utility interface within the stipulated range: -
On three Phase side: -
Output Voltage 415(±10-20%) VAC
Frequency 50Hz (±2%)
Maximum current ripple 4% PP
Reactive Power 0.95 inductive to 0.95 capacitive

The Inverter required should convert DC power produced by SPV modules, into AC power and adjust the voltage & frequency levels to suit the local grid conditions.

Common Technical Specification:
Control Type: Voltage source, microprocessor assisted, output regulation

Output voltage	: 3 phase, 415 V ac (+10 %, - 20 % Vac)
Frequency	: 50 Hz (±2%)
Dc link voltage range	: 0 to 1000 V
Total Harmonic Distortion	: less than 3%
Operating temperature Range	: -20 to +60 deg C
Inverter efficiency	: 98 % and above at full load,
Power Control	: MPPT
Protection degree	: IP65 or better
Communication interface	: Modbus RS485

Other important Features/Protections required in the string inverter:

1. Automatic morning wake-up and nightly shutdown
2. Over-under voltage and frequency protection
3. Fool proof protection against ISLANDING.
4. Included authentic tracking of the solar array's maximum power operation voltage (MPPT).
5. Array ground fault detection.
6. LCD and piezoelectric keypad operator interface Menu driven
7. Automatic fault conditions reset for all parameters like voltage, frequency and/or black out.
8. MOV type surge arresters on AC and DC terminals for over voltage protection from lightning-induced surges.
9. Inverter should be rated to operate at (-ve) 6 to 55 deg. Centigrade unless provision for air conditioning is included in inverter.
10. All parameters should be accessible through an industry standard communication link.

The inverter shall be self-commuted and shall utilize a circuit topology and components suitable for meeting the specifications listed above at high conversion efficiency and with high reliability.

Since the inverter is to be used in solar photo voltaic energy system, it should have high operational efficiency. In inverter there shall be a direct current isolation provided at the output by means of a suitable isolating transformer.

The inverter output shall be 415 VAC, 50 Hz Three phase. The inverter shall be capable of operating in parallel with the grid utility service and shall be

capable of interrupting line-to-line fault currents and line-to ground fault currents.

The INVERTER shall be able to withstand an unbalanced output load to the extent of 30%

The inverter shall include appropriate self-protective and self-diagnostic features to protect itself and the PV array from damage in the event of inverter component failure or from parameters beyond the inverter's safe operating range due to internal or external causes. The self-protective features shall not allow signals from the inverter front panel to cause the inverter to be operated in a manner which may be unsafe or damaging. Faults due to malfunctioning within the inverter, including commutation failure, shall be cleared by the inverter protective devices and not by the existing site utility grid service circuit breaker.

The inverter shall go to shut down/standby mode, with its contacts open, under the following conditions before attempting an automatic restart after an appropriate time delay; in sufficient solar power output.

a) Insufficient Solar Power Input. When the power available from the PV array is insufficient to supply the losses of the inverter, the inverter shall go to a standby/shutdown mode. The inverter control shall prevent excessive cycling during rightly shut down or extended periods of insufficient solar radiation.

b) Utility-Grid Over or Under Voltage the inverter shall restart after an over or under voltage shutdown when the utility grid voltage has returned to within limits for a minimum of two minutes.

c) Utility-Grid Over or Under Frequency the inverter shall restart after an over or under frequency shutdown when the utility grid voltage has returned to the within limits for minimum of two minutes.

The inverter generated harmonics measures at the point of connection to the utility services when operating at the rated power shall not exceed a total harmonic current distortion of 3 percent, a single frequency current distortion of 3 percent and single frequency voltage distortion of 1 percent, when the first through the fiftieth integer harmonics of 50 Hz are considered.

The inverter Power factor at the point of utility service connection shall be 0.95 lagging or leading when operating at above 25 percent of the rated output, but may be less than 0.95 lagging below 25 percent of the rated output.

The high voltage and power circuits of the inverter shall be separated from the low voltage and control circuits. The internal copper wiring of the inverter shall have flame resistant insulation. Use of PVC is not acceptable. All conductors shall be made of standard copper.

The inverter shall withstand a high voltage test of 2000 Vrms, between either the input or the output terminals and the cabinet (chassis). Full protection against accidental open circuit and reverse polarity at the input shall be provided.

The inverter shall not produce Electromagnetic Interference (EMI) which may cause malfunctioning of electronic and electrical instruments including communication equipment, which are located within the facility in which the inverter is housed.

The inverter shall have an appropriate display on the front panel to display the instantaneous AC power output and the DC voltage, current and power input. Each of these measurement displays shall have an accuracy of 0.5 percent of full scale or better. The display shall be visible from outside the inverter enclosure. Operational status of the inverter, alarms, trouble indicators and ac and the dc disconnect switch positions shall also be communicated by appropriate messages or indicator lights on the front cover of the inverter enclosure.

1.2.6. Maximum Power Point Tracker (MPPT)

Maximum power point tracker shall be integrated in the Inverter to maximize energy drawn from the array. The MPPT should be microprocessor based to minimize power losses. The details of working mechanism of MPPT shall be mentioned.

1.2.7. Disconnection, Islanding and Automatic Reconnection after the Grid Failure is restored

Inverter shall have facility to reconnect automatically to the grid following restoration of grid, subsequent to grid failure condition. The system should have integrated system control and software for plant control and remote communication with web monitoring to monitor individual strings and complete power plant from inverter.

1.2.8. Integration of PV Power with Grid

The output power from SPV would be fed to the inverters which converts DC produced by SPV array to 415V AC. The AC power is then fed to the LV side of step-up transformer which then steps up to 11kV. The 11kV AC power is fed to the main electricity grid after synchronization. In case of grid failure, or low or high voltage, solar PV system shall be out of synchronization and shall be disconnected from the grid.

1.2.9. Data Acquisition System/ Plant Monitoring

Basically, this unit should perform the following:

(i) Individual Array monitoring.
(ii) Measurement and/or recording of energy parameters.
(iii) Simple data logger or energy meter to record the energy data on a predetermined interval basis.
(iv) Measurement & continuous acquisition of ambient air temperature, solar radiation, PV module temperature, individual string current, and inverter output voltage and current, output frequency.
(v) Operating state monitoring and failure indication.
(vi) Representation of monitored data's in graphics mode or in tabulation mode.
(vii) Controlling & monitoring the entire power system through remote a local terminal.
(viii) Controlling & monitoring the entire power system through remote local terminal.

(ix) Necessary hardware & software shall have to be supplied by the successful bidder. Both the software and hardware required for interfacing the plant including modems, Printers, UPS, Cellular device are to be supplied and installed by the successful bidder.

(x) Remote control/ Instrumentation: The microprocessor control unit should have the provision for installation of RS – 232/485 communication link, should remote control and monitoring capability (by personal computer) be desired. All parameters, status and indicators and targets accessible through the local operator interface may be accessed remotely through these ports. Optional analog outputs (0-5VDC) for DC powers, DC current, DC Voltage can be supplied to interface with external data acquisition systems. Optional contacts inputs from an external SCADA/RTU or other remote control device can be provided within the inverter enclosure for remotely disabling or resetting the unit.

(xi) The site shall be sufficiently protected against with checks, measures and preventive mechanisms in place as provided herein below. However in case of any leakage in power if any and in the unlikely case of any leakage happening it shall be stemmed and stopped immediately with minimum damage.

1.2.10. 11kV Switchgear

One 11kV Metal Clad ICOG Switchgear shall be of outdoor type. The switchgear shall be provided with positive safety electrical interlocking and busbar earthing facilities for operational and personnel safety. The general technical requirement of 11kV switchgear shall be as follows:

i.	Type	: Metal clad, horizontal draw out.
ii.	Service	: Outdoor type
iii.	Quantity	: 1no.
iv.	Enclosure	: IP65 or better
v.	Voltage	: 11000 V
vi.	Phase	: 3
vii.	Frequency	: 50 Hz
viii.	Rated short circuit current for 1 sec	: 20kA

Energy Metering

The bidirectional electronic HT tri-vector energy meter (0.2S Accuracy Class) shall be installed for the measurement of import/export of energy from the plant.

1.2.11. Power Transformer

(i) Dry-type outdoor 250kVA capacity, 415V/11kV, 50Hz Step-up along with all protections, switchgears, vacuum circuit breakers, cables, etc with enclosure of IP65 protection or better.

(ii) The tenderer must take approval/NOC from the Employer for connectivity, technical feasibility and synchronization of SPV plant with distribution network.

1.2.12. Protection

The system should be provided with all necessary protections like earthing, lightning and grid islanding as follows:

1.2.12.1. Lightning Protection

There shall be the required number of suitable lightning arrestors installed in the array field. Lightning protection shall be provided by the use of metal oxide varistors and suitable earthing such that induced transients find an alternate route to earth. Protection shall meet the safety rules as per Bhutan Electricity Act

1.2.12.2. Surge Protection

Internal surge protection shall consist of three MOV type surge-arrestors connected from +ve and –ve terminals to earth (via Y arrangement).

1.2.12.3. Earthing Protection

Each array structure of the PV yard should be grounded properly. In addition, the lighting arrester/masts should also be provided inside the array field. Provision should be kept for shorting and grounding of the PV array at the time of maintenance work. All metal casing/shielding of the plant should be thoroughly grounded in accordance with Bhutan Electricity Act /IE Rules. The earthing arrangement shall be followed asper the electrical drawing and interconnected with a copper strip. The resistance value of the earthing should be less than 2 ohms.

1.2.12.4. Grid Islanding

Disconnection of the PV generator in the event of loss of the main grid supply is to be achieved by in built protection within the power conditioner. This may be achieved through rate of change of current, phase angle, unbalanced voltage or reactive load variants. Operation outside the limits of power quality as described in the technical data sheet should cause the power conditioner to disconnect the grid.

In case of the above, tripping time should be less than 0.5 seconds. Response time in case of grid failure due to switch off or failure based shut down should be well within 5 seconds

Automatic reconnection after the grid failure is restored:

Inverter shall have facility to reconnect the inverter automatically to the grid following restoration of grid, subsequent to grid failure condition. The system should have integrated system control and software for plant control and remote communication with web monitoring to monitor individual strings and complete power plant from Inverter.

1.2.13. Cables

Cabling in the yard: Cabling in the yard shall be carried out as per IE Rules.

Wires: Only FRLS copper wires with size as per the electrical drawing and of reputed make shall have to be used.

Cables Ends: All connections are to be made through suitable cable/lug/terminals; crimped properly & with use of Cable Glands.

Cable Marking: All cable/wires are to be marked in proper manner by good quality ferule or by other means so that the cable can be easily identified. Any change in cabling schedule/sizes if desired by the Bidder/supplier be got approved after citing appropriate reasons. All cable schedules/layout drawings have to be followed as per the electrical drawings provided. All cable tests and measurement methods should confirm to IEC 60189.

Multi Strand, Annealed high conductivity copper conductor

- PVC type 'A' pressure extruded insulation
- Overall PVC insulation for UV protection and confirm to IEC 69947
- Armoured cable for underground laying
- All cables shall conform to BIS standards (IS 694) and (IS 1554)
- The size of each type of cable selected shall be based on minimum voltage drop, however, the maximum drop shall be limited to 2%.
- Selected cable should carry a current density of minimum 1.2Amp/Sq.mm
- Proper laying of cables have to be ensured in appropriate cable trays, pipes / trenches as per site requirement.
- A.C. supply cables to be terminated at the DB / LT bus bar.
- For laying / termination of cables, latest BIS / IEC codes / standards be followed.

1.2.14. Miscellaneous

a. Proposed tentative BOM indicating major components shall be submitted
b. All items against which no make has been mentioned must confirm to ISI standards
c. For complete work, tenderers shall carryout the work as per the drawings (both civil and electrical), technical specifications and instructions provided by the Employer.

1.2.15. Tools & Tackles and Spares

After completion of installation & commissioning of the power plant, necessary tools & tackles are to be provided free of cost by the successful bidder for maintenance purpose. List of tools and tackles to be supplied by the successful bidder for approval of specifications and make.

The contractor shall stock adequate recommended spares at site for operation and maintenance of Solar PV Plant.

1.2.16. Fire Extinguishers

(i) The fire-fighting system for the proposed power plant for fire protection shall be consisting of:
    a. Portable fire extinguishers for fire caused by electrical short circuits
    b. Sand buckets
    c. The fire extinguishers shall be inside the plant premise.

1.2.17. Drawings and Manuals

(i) Tenderers shall provide complete technical data sheets for each equipment giving details of the specifications along with make/makes in their bid along with basic design of the power plant and power evacuation, synchronization along with protection equipment.
(ii) Approved ISI and reputed makes for equipment be used.

(iii) For complete works, the successful bidder shall carryout the work in accordance to the drawings (civil & electrical both), technical specifications and instruction provided by the Employer.

1.2.18. Planning and Designing

The successful bidder shall plan and execute the work in accordance to the project schedule provided by the Employer. The design and technical specification for civil and electrical works are complete and provided by Employer. The successful bidder shall follow the same.

1.2.19. O&M Training

The bidder shall provide detailed training plan for all operation and maintenance procedures, which shall after approval by Employer, form the basis of the training program. Contractor shall impart training on site and at Bidder's existing solar farm/factory to Employer's engineers in O&M of Solar PV Plant and its associated equipments. The bidder shall ensure that the training imparted are sufficient for the operation and maintenance activities of the plant.

1.2.20. Statutory Approvals

All the statutory approvals / clearances, wherever required, from Government departments will be obtained by BPC.

1.2.21. Erection, Testing and Commissioning

The scope of installation, testing and commissioning for the plant facilities shall include, but not limited to the following:

i. Erection of module structures and Installation of PV modules on module mounting structures and interconnection of PV modules.
ii. Laying of solar cables through HDPE conduit underground from PV Modules to SCB and to PCU along with termination at both the ends.
iii. Installation, testing and commissioning of solar PV panels, inverters, SCBs, LT outdoor switchgear, dry type transformers, and 11kV IGOG outdoor switchgears.
iv. Laying of 11kV AC cables in trench from Transformer secondary side to the nearest 11kV pole with terminations at both end.
v. Installation, testing and commissioning of HT meters with all necessary metering rated CTs and PTs.
vi. Installation, testing and commissioning of SCADA hardware, software and suitable communication system for interfacing PCU/Inverter, LT switchgear panels, transformers, HT switchgear pane.
vii. Earthing of PV modules, module mounting structures, SCBs, inverters, LT and HT switchgears, Lighting Arrestors, transformer and all other electrical equipments.
viii. Installation of lightning protection system for entire plant facilities.
ix. Installation of fire protection system for the entire plant facilities.
x. Pre-commissioning checks and tests for all equipment.
xi. Synchronization and commissioning of plant.
xii. All other works related to installation, testing and commissioning which are not mentioned but required to complete the solar power plant facilities in all respects.

1.2.22. Infrastructure

Suitable arrangement of water to be ensured to during construction and cater the day-to day requirement of drinking water and other needs of solar farm during the construction of the project.

a. Construction of ramping arrangements at Rubessa and approach roads.

b. Water Supply Arrangement.

c. Watch & Ward.

1.2.23. Manpower & Utilities

a. The contractor shall give details of competent & eligible manpower to be deployed at the site for store management, installation, testing & commissioning of solar energy project.

b. Deploy at site adequate qualified manpower, cranes, special tools & tackles, required consumables, measuring & testing equipments. Arranging construction power &water as required for installation and commissioning of the project.

1.3 Language

The English language shall be used in all Contract documentation and in all correspondence between the Contractor and the Employer.

1.4 Units of Measurement

Metric units of measurement (System International) shall be used in all Contract documentation. Angular measurement shall in degrees with 90 degrees comprise one right angle.

1.5 International Standards

All Equipment and the Works under this Specification shall conform to the latest editions of the Institute of Electrical and Electronics Engineers (IEEE) or International Electro-Technical Commission (IEC) or Bureau of Indian Standards (BIS) Specifications.

1.6 Access

The Project Site (Rubessa) is accessible from the nearest bordering districts of Phuentsholing and Gelephu bordering West Bengal and Assam State of India respectively by road and Paro (International Airport), Bhutan and Guwahati/Bagdogra by air in India. Bidders are informed that to visit and work in the project locations, special permits from the Ministry of Home and Cultural Affairs are required to be processed from Thimphu and Regional Immigration Offices located at Phuentsholing, Gelephu and Samdrupjongkhar.

For processing the permits, BPC will provide only assistance and permits need to be processed by contractor themselves. Such cost shall be borne by the contractor.

1.7 Packing and Shipping

The Power Plant equipment/accessories shall not be shipped/ dispatched unless dispatch clearance from Employer/Engineer is issued. The dispatch clearance will be issued from the BPCs office after the inspectors submits its inspection report to BPC, within 4 working days after the submission of the report.

Any items liable to be damaged in transit shall be effectively protected and securely fixed in their cases. All cases of over 2 tonnes shall be marked to show where slings should be placed.

All cases shall be clearly identified giving particulars of manufacturer's name and type of equipment. All identification marks on the outside of cases shall be waterproof and permanent. All electrical equipment shall be adequately sealed and desiccating agents used where necessary to prevent damage from condensation. All equipment shall be packed and protected, bearing in mind that it will be shipped to a harsh environment, that a considerable period may elapse between its arrival on site and it’s unpacking and that covered storage may not always be possible.

All wood and other materials used in packing cases shall be insect free. Adequate protection and precautions are to be taken to exclude termites and other vermin, noxious insects, larvae or fungus from the packing materials or plant. All contents are to be clearly marked for easy identification against the packing list.

The Contractor shall protect all steelwork before shipment, to prevent corrosion and/ or damage. Bundles of steel sections shall be properly tied together by an approved method and care shall be taken to ensure that they are robust and that they can be handled easily during shipment.

Bolts and nuts shall be double bagged and crated for shipment. Crating of dissimilar metals is not acceptable.

Packing cases where used, shall be strongly constructed and in no case shall timber less than 25 mm in thickness be used. The contents of packing cases shall be securely bolted or fastened in position with struts or cross battens. Cross battens supporting weight in any direction shall not rely for their support on nails or screws driven lengthwise into the grain of the wood, but shall be supported by cleats secured from inside.

1.8 Labels

All equipment shall be provided with labels or name plates, giving a description of the equipment, together with information regarding the rating, nominal Voltage, nominal current and the like under which the item of plant in question has been designed to operate. The labels shall be permanently attached in a conspicuous position. Where this is not practicable, such labeling shall be provided on packaging to the Engineer's approval.

Labels shall be made of non-rusting metal or 3-ply lamicoid. Labels shall have white letters on black or dark blue background. The lettering size shall be 6 mm for panel designation and minimum 3 mm for device labels. The label inscriptions shall be subject to the Employer's approval.

1.9 Quality Assurance

The Bidder shall submit in the tender an outline of the quality assurance practices that will be applied to all aspects of the manufacturing process.

Within one month of receipt of a letter of acceptance (LOA) under this for equipment specification and civil works, the Contractor shall submit a detailed Quality Assurance Manual, which conforms generally to the requirements of ISO 9002. Approval to proceed with manufacture of equipment within this Contract will not be given until this Quality Assurance Manual has been received and approved by the Engineer. Delays to the Contract completion date due to non-compliance with this specification requirement will be the Contractor's responsibility.

Major features of the Quality Assurance (QA) Scheme practiced by the Contractor and detailed in his Quality Assurance Manual shall be:

a) The Contractor has defined all staff responsibilities and the QA systems operating within the organisation for the purpose of ensuring adequate quality of the end product.

b) The Contractor has a senior officer with the authority to resolve matters of quality to the satisfaction of the Engineer.

c) The Contractor has adequate facilities under the control of properly trained staff to perform the quality control duties.

d) All production operations and test functions are properly documented and available to any relevant member of the Contractor's workforce.

e) A detailed inspection and test plan is prepared for the whole manufacturing operation.

f) Regular and systematic programs of testing are carried out for all incoming raw materials.

g) Regular calibration checks are carried out on all measuring equipment used in the manufacturing operations.

h) Statistical analyses are carried out regularly on appropriate test results to confirm that all processes are performing within the specified tolerances.

i) Adequate procedures are planned for corrective action in the event that quality checks show that performance is not satisfactory.

j) All checking activities, test results etc. are recorded on appropriate standardised forms and these are verified, certified, recorded and filed in a systematic manner.

1.10 Site Services

1.10.1 Living Accommodation

The Contractor has to make his own arrangements with regard to accommodation for his expatriate/local staff during the supervision of erection.

All dwellings and buildings existing or erected for any purpose by the Contractor shall comply with local regulations in regard to construction, water supply, sanitation and other requirements. The Contractor is responsible for seeking approval from concerned authority whenever required to take up infrastructure works like construction of site office, labour camps, site stores, etc. Temporary construction camps are to be provided with proper sanitation and other necessary facilities. All temporary accommodation shall be removed by the Contractor when no longer required and before the granting of the Final Certificate. After the removal of accommodation, the ground shall be left in a clean and tidy condition.

1.10.2 Office Accommodation

The Contractor is to bear all expenses in connection with their office accommodation, accommodation of the staffs, temporary housing and things required for the purpose of the Contract.

1.10.3 Medical Facilities

The Employer will not provide these and the Contractor shall make his own arrangements where these services may be required for his staff.

1.10.4 Labor Work Permits, Accommodation and Insurance

It will be the responsibility of the Contractor to ensure that all grades of expatriate labour have the current and correct work permits and or Visas, and to comply in every way with the immigration and or emigration regulations. The contractor shall also ensure that they comply with the labour laws of the country and the requirements for leave, accommodation and insurance of all his employees and the employees of his sub-contractors. The Contractor in all dealings with labour in his employ shall have due regard to all recognised festival days of rest and religious or other customs.

1.10.5 Transport to Site

The Contractor is to bear all expenses in connection with the transport to Site of all plant, material and things needed for the purpose of the Contract including warehouse rent, handling and other charges, which may occur. The Contractor is to observe any regulations, which limit loads on roads and bridges over which material may be conveyed.

1.10.6 Plant Handling and Storage

The handling and storage of any plant at the Site will be the responsibility of the Contractor. The Contractor shall arrange for suitable lay-down areas. The Contractor is to advise on the protection of all material against corrosion, theft, and mechanical damage during storage and erection at the Site.

Only galvanised structural steelwork may be stored in the open. Plant sensitive to climatic conditions must be stored in closed buildings protected from dust and humidity.

1.10.7 Access

The Contractor will be responsible for the construction and maintenance of any temporary roads. When haulage or construction roads are no longer required the Contractor shall break up hardened surfaces, remove all imported material, and shall reinstate the original surface and topsoil of the disturbed areas to a natural condition.

1.10.8 Site Sanitation

The Contractor shall ensure that every construction site is maintained in a clean and sanitary condition. The Contractor shall provide refuse collection and disposal services including sweeping of paved streets and cleaning of drainage channels. Adequate mobile or other toilets shall be provided at the work sites controlled by the Contractor. The Contractor shall ensure that such toilets remain in a hygienic condition.

1.10.9 Construction Power Supply

Contractor shall make his own arrangements for construction power supply and pay the requisite charges/fees to the BPC.

1.10.10 Lighting and Power

All power and lighting circuits shall be constructed with due regard for personnel safety and shall comply with recognised codes of practice and local regulations. All circuits shall be fitted with earth leakage systems.

1.10.11 Spoil Areas

Disposal areas for equipment foundation spoil shall be determined by mutual agreement with the Engineer, the Employer, land owners, and local authorities. It shall be the responsibility of the Contractor to ensure that spoil does not negatively impact the natural beauty, the function or ecosystems of the area. It will be the responsibility of the contractor to properly dispose off excavated soil at the designated place by the municipal corporations.

1.11 Contractor's Responsibility

1.11.1 Safety of Personnel

The Contractor shall afford maximum safety to personnel directly engaged on this Contract or to persons who, in the normal course of their occupation, find it necessary to utilise temporary works erected and to frequent the working area. Additional safety regulations to be followed by the Contractor at site are attached with the specifications.

Once any section of the plant has been made alive; the Contractor, the Engineer and the Employer shall establish and agree to a system for ensuring the safety of personnel and equipment. While the plant is under the control of the Contractor, the Contractor shall be primarily responsible for the safety precautions.

It will be mandatory under this contract to provide at least safety helmets and gumboots to all the personnel working at the site.

1.11.2 Contractor's Employees

The Contractor shall provide adequate transportation, accommodation, boarding and medical facilities for all personnel in his employ. He is also to comply with the requirements of all relevant Labour Laws of Bhutan.

The Contractor shall be responsible for the behavior on site of all personnel employed by him.

1.11.3 Training of Local Staff

The Contract shall include for the training of the Employer's employees in the areas corresponding to installation, testing and commissioning power plant equipment and general O&M of the plant at the site for period of 10 days at the site.

1.11.4 Progress Reports

At monthly intervals, the Contractor shall submit to the Engineer detailed progress reports (in triplicate) in an approved form indicating the stage reached in ordering of material, manufacture, delivery and supervision of erection of all components of plant. All variances from the agreed schedule are to be promptly reported. These reports shall be forwarded promptly so that, on receipt by the Engineer, the information contained therein is not more than seven days out of date. One copy shall also be forwarded to the Engineer's representative on Site. These reports shall be prepared using project management software like Microsoft Project. The soft copies of the report shall also be supplied to the Engineer/ Employer.

The Contractor shall submit to the Engineer a weekly return detailing for each portion of the works separately, the numbers of the various classes of workmen employed by him on the Site, the Contractor's equipment on site, or any other information that may reasonably be required.

Access to the Contractor's and Sub-contractor's works shall be granted to the Engineer and Employer at all reasonable times for the purpose of ascertaining progress.

1.11.5 Progress Review Meetings (PRM)

The Contractor shall attend regular formal site progress review meetings with the Engineer where progress and construction-related issues will be reviewed. The Contractor shall prepare for issue the day before the meeting, detailed schedules showing separately the erection, fixing, concreting, commissioning, or other work activities planned for the next two weeks as well as progress achieved over the preceding week.

The Contractor shall also be required to attend other meetings from time to time as required for the project and the person representing the contractor shall be fully empowered to take decisions at such meetings.

1.11.6 Relations with Local Residents and Authorities

The Contractor shall liaise with local authorities on matters concerning the impact of his operations on the local communities. Any problems that cannot be resolved by the Contractor shall be referred to the Employer through the Engineer.

1.11.7 Public Relations

The Contractor shall not publish or provide any information relating to progress or financial status of the works to any person or organisation without the prior consent of the Employer.

1.11.8 Environmental Considerations

The Contractor shall ensure that construction does not negatively impact the natural beauty, the function, the amenities, or the ecosystems of the area and care shall be taken to prevent permanent damage.

All rivers and streams shall be protected from direct or indirect spills of pollutants resulting from the Contractor's activities.

The Contractor shall provide drainage facilities at site, and shall revetate the surface where necessary to prevent erosion and consequent weakening of the foundations.

The Contractor shall as far as possible, protect the flora within the work sites. If areas are disturbed beyond the designated work boundaries, the Contractor shall reinstate the ground and re-establish suitable Vegetation as directed by the Engineer at no extra cost to the Employer. Such re-establishment shall take place as soon as practicable after the Engineer's request.

The Contractor and his employees shall protect all faunas living within the site area and shall ensure that hunting, shooting, bird nesting, egg collecting, or trapping does not occur. Permits to cut any trees shall be obtained from the relevant authorities through the Employer.

The Contractor shall as far as possible, restrict the dust pollution due to digging activities. Special care shall be taken to reduce the pollution by spraying water at regular intervals as per the directives of engineer or

supervisor so that the effects of dusts and inconvenience to the public are minimized.

Contractor shall mobilize the workforce, equipment and start the work only after getting environmental clearance from National Environment Commission. BPC shall process for theses clearances and hand over to the contractor at as early as possible after signing of the contract agreement.

The work site shall be kept neat and clean at all the times. Proper house keeping of the site and store shall be done as directed by the engineer in charge as per the directives at the site without any extra cost to the employer.

1.12 Documentation

1.12.1 General

In addition to the documentation requirements set out in the Conditions of Particular Application, the Contractor shall provide the information requested below.

Unless otherwise specified, 3 (three) copies of every item of submission shall be submitted by the Contractor.

1.12.2 The essential drawings and information shall be submitted to the Employer for approval after signing of the contract agreement before the work is put in hand.

1.12.3 Following drawings shall be enclosed with the bid:

The program in the form of a network based on the principles of PERT/CPM, detailed to cover entire scope of the project showing all activities, their duration, start and finish dates and their inter-relationships and major milestones.

1.12.4 Test and Inspection Documents

The Contractor shall submit to the Engineer for approval a summary table of tests and inspections to be carried out in the manufacturer's works and at site at least 2 months before the first scheduled activity.
The schedule shall include:

- Raw materials test and inspections;
- Workshop tests and inspections;
- Site tests and an inspection, including pre-commissioning and commissioning tests.

The Contractor shall submit detailed procedures for the site tests for approval at least one month in advance of the corresponding activities, including:

- Descriptions of the inspection and test methods;
- Test or inspection sheets with dimensions and blank spaces for entering of measured values;
- Proposed dates and locations of tests and inspections.

The Contractor shall submit all final test and inspection reports to the Engineer for approval, in the case of manufacturer's works activities, before shipment of the corresponding plant items.

1.12.5 Dispatch Documents

The Contractor shall supply consignment notes bearing the reference number of each dispatch, and a list of the contents of each crate, identification numbers, dimensions, net and gross weights and where necessary, any special instructions regarding storage and the type of packaging/ handling.

1.13 Applicability of the requirement

The general specification and requirement shall be applicable to all the equipment and work under the contract. The equipment manufactured shall be in compliance with the general specification and detailed technical specification.

1.14 Type Tests

All equipment/materials shall confirm to type tests including routine acceptance and additional special tests in accordance with the relevant Standards and Codes. The Bidder shall submit copies of type test for each equipment during detail engineering. The type tests report submitted shall be of the tests conducted within the last five (5) years prior to the date of Bid opening. In case the type tests reports are of the tests conducted earlier than five (5) years prior to the date of Bid opening, the Contractor shall repeat these test(s) at his own cost.

Section 2B – Technical Specification

SECTION 2B: TECHNICAL SPECIFICATIONS

TABLE OF CONTENT

1. Solar Photovoltaic Modules

1.1 The solar PV modules of following details is required:

Sl. No	Description	Parameters
1	Rating	345 Wp
2	Total Electrical Capacity of the plant	180,090 W/180kW
3	Total required Solar PV Panel	522 Nos
4	Type	Polycrystalline with minimum 5 years in commercial existence and having successful operating references working in similar operating conditions.
5	Fill factor[1]	> 75%
6	Efficiency	> 17%
7	Module Performance: Power output guarantee	> 95% of nominal power for first five years and then power degradation to not exceed 0.4% per annum till 25th year. Provide >80% of the nominal power after 25 years.
8	Mounting arrangement for PV module	Ground fixed-mounted facing south to maximize the power output.
9	Cable gland at module junction box	Yes, to be provided with the modules
10	Maximum temperature rise of cell over ambient temperature	< 85 ^{o}C
11	Temperature Coefficient of Power (Tc)	< (-) 0.4%/ ^{o}C
12	Junction Box	IP 68 rated 3 bypass diodes and 1000mm output cables with Multi-contact (MC4/TS4 connectors)
13	Front Glass	High transitivity/ High Transmission tempered glass with Anti-reflective (AR) coating
14	Module frame	Anodized aluminum alloy type 6063
15	Wind load withstand	245kg/m^2 (2400 Pa) front and back
16	Module warranty	25 years (Both for Power and Performance)

1.2 Modules

- The total solar PV capacity should be as same as specified in the technical drawings, i.e. 180,090 W.
- Adequate protective devices against surges at the PV module shall be provided. Low voltage drop bypass diodes shall be provided.
- The module frame shall be made of corrosion resistant materials preferably having anodized aluminium.
- The bidders or developers shall accommodate requisite numbers of the modules as per the design provided in civil drawings to achieve the rated power.

[1] Fill Factor (%) = $[(V_{mpp} * I_{mpp}) / (V_{oc} * I_{oc})] * 100\%$

- The modules shall be provided with a junction box with either provision of external screw terminal connection or sealed type and with arrangements for provision of by-pass diode. The box shall have hinged, weather proof lid with captive screws and cable gland entry points or maybe of sealed type and IP68 rated. Each junction box shall have hight quality suitable capacity Metal Oxide Varistors (MOVs)/ SPDs, suitable Reversed Blocking Diodes. Suitable markings shall be provided on the JB bus bar for easy identification and the cable ferrules must be fitted at the cable termination points for identification.

- Each PV Module shall be provided with a RFID tag, provided inside Module laminate specifying following information
    - Name of manufacturer of Solar Module
    - Name of manufacturer of Solar Cell
    - Unique serial number and Model no of Module
    - Month and Year of manufacture
    - Country of Origin
    - I-V Characterestic
    - Peak Wattage, Im, Vm, FF of Module
    - Date and Year of Obtaining PV Module IEC qualification certificate
    - Name of Test lab issued certificate
    - Other information to trace PV module as per ISO9000

1.3 Warranties

i. Material Warranty:

- Material warranty is defined as: The project developer should warrant the solar Module(s) to be free from the defects and/or failures specified below for a period not less than five (5) years from the date of sale to the contractor/ developer.
- Defects and/or failures due to manufacturing.
- Defects and/or failure due to quality of materials.
- Non conformity to specifications due to faulty manufacturing and/or inspection processes. If the solar module(s) fails to conform to this warranty, the project developer/contractor shall repair or replace the solar module(s).

ii. Performance Warranty

- The predicted electrical degradation of power generated not exceeding 20% of the minimum rated power over the 25 years' period and not more than 10% after ten years period of the full rated original output.

1.4 Codes and Standards

The module type must be qualified as per the following codes and standards:

1. IEC Codes: IEC 61215 Ed. 2, IEC 61730-I and IEC 71730-II
2. ISO Codes: ISO 9001:2008 and ISO 14001

Equipment and material conforming to any other standard, which ensures equal or better quality, may be accepted subject to approval of the Employer. In such case, copies of the English version of the standards adopted shall have to be submitted along with the bid.

The electrical installation shall meet the requirements of Indian Electricity Rules 1956, Central Electrical Authority's rules and regulation as amended up to date and relevant

IS Codes of Practice. In addition, other rules and regulations applicable to the work shall be followed.

***Note**: Any other items missed out shall be incorporated by the bidder.

1.5 Data Sheet

Data sheet of the offered module shall be submitted along with the offer giving under STC details of peak power, peak power current, short circuit current, fill factor, temperature de-rating, peak power voltage, open circuit voltage, module dimensions and weight, etc. Instructions shall contain full details and drawings of equipment, the transportation, storage, installation, testing, operation and maintenance procedures, etc.

1.6 Test Report

Flash test report shall be supplied for approval before shipment of modules. The report shall indicate clearly the standard value specified for each test to facilitate checking of the reports.

1.7 Spare Parts

10 numbers additional solar panels shall be provided as spares and any other relevant critical spares required for the operation and maintenance.

1.8 Testing and Commissioning

Field tests shall be done as per the international standards and instruction from the employer. The damages and defects during and after installation within the guaranteed period will be under the scope of bidder and it shall form the final basis to establish fulfilment of guarantee of the panels.

International standards should be followed while conducting any test required to be conducted during pre/post commissioning at the site for the installed solar panels. Any standards missed out in codes & standards mentioned above should be incorporated by the bidder after consenting with the employer.

2. Mounting Structure

- The mounting structure shall be implemented as specified in the civil drawings and BoQ attached.

3. String Combiner Boxes (SCBs)

a) The combiner boxes shall act as DC Distribution Board (DCDB) before terminating to the Inverter.

b) There will be 27 number of strings, out of which 15 strings will have 18 numbers of panels connected in series in a string and 12 strings will have 21 numbers of panels connected in series in a string. The 27 number of panels are equally divided into three inverters. That is, 5 strings of 18 panels in series and 4 strings of 21 panels in series will be connected to each inverters.

c) Before terminating into the inverters, these strings shall be first combined in a String Combiner Boxes (SCB). Two types of SCBs are designed for this system:

i. 3 numbers of 6IN-1OUT SCBs. These SCBs shall terminate the 5 strings of 18 panels in series. The one extra string input in the SCB shall be kept as spare.
ii. 3 numbers of 4IN-1OUT SCBs. These SCBs shall terminate the 4 strings of 21 panels in series.

d) The details of these SCBs are provided in the electrical drawings.
e) The combiner boxes are to be provided in the PV array for termination of strings (panels connected in series as shown in the electrical drawing). It shall be made of GRP/FRP/Powder Coated Aluminium/ cast aluminium alloy/UV/IR protected with dust, vermin and waterproof arrangement. All wires/cables must be terminated through suitable cable glands.
f) Coper bus bars/ terminal blocks housed in the combiner box with suitable termination threads confirming to IP65/IP66 standard and IEC 62208 hinged door with EPDM rubber gasket to prevent water entry, single compression cable glands and provision of earthing shall be in place.
g) The size, specification and placement of the combiner box shall be same as that provided in the electrical drawing.
h) Each combiner boxes shall have high quality suitable capacity Metal Oxide Varistors (MOVs)/ surge arrestors, suitable Reverse Blocking Diodes. The combiner box shall have suitable isolation switches to isolate the DC input from each array individually to Inverter.
i) Suitable markings shall be provided on the bus bar for easy identification and the cable ferrules must be fitted at the cable termination points for identification.
j) The size and type of MCBs/MCCBs and surge arrestors shall be same as that provided in electrical drawings.
k) If in case diodes, HRC fuses, SPDs and isolators are installed in the string inverters, then also there is need to install these in SCBs. If some of these safety gadgets are not installed in string inverters, it should be installed in SCBs.
l) Cable interconnection arrangement shall be within conduit pipe on saddles installed properly.
m) Cable connection should be done in such a manner that fault finding if any, can be identified easily. The cables should be connected in such a manner that clamp meter can be comfortably inserted around the individual cables to measure the data like current, voltage, etc.
n) The SCBs should be marked as S1, S2, and so on. Wherever conduits are laid, should be suitable laid in cable tray or appropriate civil structure.

***Note**: Any items missed out shall be incorporated by the tenderer.

4. Inverter

a) The inverter should convert DC power produced by Solar PV panels, terminating from the string combiner boxes, into AC power and adjust the voltage and frequency levels to suitable to the local grid conditions.
b) The inverter shall also house two MPPTs (Maximum Power Point Tracker), an interface between solar PV and the inverter.

c) The inverter selected for 180kW solar plant shall confirm to the following specification:

Particulars	**Nominal PCU Output Rating**	**Operating Voltage Range**	**AC Output with 50 Hz frequency**
3 string inverters of 60kW each	60kW	200V to 1000V	415V 3-Phase
Peak & Euro Efficiency	>98%		
Maximum Input DC Voltage	1100 Vdc		
Operating temperature range	-25 ^{o}C to 60 ^{o}C		
Protection	Type 2 SPD		
Protection level	IP65 (minimum) for outdoor inverter		
MPPT	2 numbers		
THD	< 3%		
Switching devices	IGBT/MOSFET		
Control	Microprocessor/ DSP		
Communication Compatible	Yes, Inverter shall have communication compatibility through wire and wirelessly.		
Communication Port	Modbus RS485 Compatible		
No-load losses	< 1% of the rated power		
Power Factor	>0.9		
Dimension(WxHxD,mm)	615 x 962 x 275		
Certification Required	IEC 600068-1,2,14 and 30 or Equivalent: Environment, IEC 61000-3-15 EMC, IEC 61683/ IS 61683 and IEC 60068-2(1,2,14,30)- Efficiency requirements as specified above, IEC 62116/IEEE1547/UL1741-Islanding prevention of utility interconnected PCUs, IEEE 1547- Interconnecting Distributed sources, IEC 61727 UL1741-Safety of inverters in distributed energy sources. **Certification as per equivalent standards for above standards are also acceptable.`**		

d) The inverters should be labelled as INVERTER-1, INVERTER-2 and INVERTER-3 as shown in the electrical diagram. The connection from SCBs to inverters shall be followed as per the electrical drawing provided.

e) PCU/Inverters shall be capable of complete automatic operation including wake-up, to monitor plant performance.

f) The PCU/inverters should comply with applicable IEC/equivalent BIS standard for efficiency measurements and environmental tests as per standard IEC codes.

g) The PCU/inverters should be approved by international test houses.

h) Module technologies where +ve or –ve grounding is required needs to be identified by bidder and accordingly selection of PCU needs to be done by bidder.

i) PCU/Inverter shall be self-commuted and shall utilize a circuit topology and components suitable for meeting the specifications listed above at high conversion efficiency and with high reliability.

j) Built-in meter and data logger to monitor plant performance through external computer shall be provided.

k) Anti-islanding (Protection against islanding of grid): The inverter shall have anti-islanding protection in conformity to the standards mentioned in the above table or equivalent BIS standard.

l) The PCU/inverter generated harmonics, flicker, DC injection limits, Voltage range, Frequency Range and Anti-Islanding measures at the point of connection to the utility services should follow the latest CEA (Technical standards for connectivity distribution generation resources) Guidelines.

m) The PCU/inverters should be tested from the MNRE approved test centers/ NABL/ BIS/ IEC accredited testing – calibration laboratories. In case of imported PCUs/inverters. These should be approved by international test houses.

5. Protection and Safety

- Both AC and DC lines should have suitable MCB/ MCCB, contractors, SPD, HRC (High Rupturing Capacity) fuse, etc as per the electrical drawing to allow safe start up and shut down before and after string inverter installed in the system.
- String Inverters should have protections for overload, surge current, high temperature, over/ under voltage and over/ under frequency and reverse Polarity. The complete operation process and safety instructions should be printed and suitably pasted near the inverters.
- Inverter should have safety measures to protect inverter from reverse short circuit current due to lightning or line faults of distribution network. This shall be followed as per the electrical drawing.
- Inverter and SCB should be suitable placed on a concrete platform, located as per the inverter and SCB layout of electrical diagram.

6. Lightning and Over Voltage Protection

The SPV power plant should be provided with lightning and over voltage protection. The principle aim in this protection is to reduce the over voltage to a tolerable value before it reaches the PV or other sub-systems components. The lightning arrestor (LA) is to be made of 1.25" diameter (minimum) and 4 meter long. Necessary foundation for holding the LA is to be arranged keeping in view the wind speed of the site and flexibility in maintenance in future. Each LA should have delicately earthed as shown in electrical diagram, through suitable size earth bus with earth pits. The earthing pits shall have to be made as per IS 3043. Two such LA shall be installed for the plant as shown in the electrical diagram to protect the array field, all machines and control panels installed.

7. Earthing Protection

- Applicable standards: ANSI/IEEE Std. 80 & 142, IEC 61024, IS: 2303, IS: 3043, IS: 2309.

- Each array structure/ rows as described in the electrical drawing of the PV yard shall be grounded properly. Separate DC and AC earthing system shall be provided as per the electrical drawing.
- The plant shall have 3 DC Earthing pits as shown in the electrical drawing provided. These earthing pits shall be connected with copper strips. In each array/row every module should be connected to each other with copper wires.
- The earthing pits shall have a maximum resistance value of 2 ohms.
- All metal casing/ shielding of the plant should be thoroughly grounded in accordance with IE rules as amended up to date. The earthing pit shall be made as per IS: 3042.
- All the array structures, equipments, inverters and control system shall be compulsorily connected to the earth.
- Copper strips should be used for connecting earthing instead of G.I. wires.
- LA should be installed to protect the array field, DC and AC control panels and transformer.
- Separate earthing for the AC system (Transformer, LV and 11kV Panels) shall be provided. And separate earthing shall be provided for Lightning Arrestors.

8. 415V/ LV Outdoor AC Distribution Panel Board

- LV AC Distribution Panel Board shall control AC power from PCU/ inverter and should have necessary surge arrestors. Interconnection shall conform to the connection diagram provided in electrical drawings.
- All switches should conform to IEC 60947, part I, II and III/ IS 60947 part I, II and III.
- The panel shall be metal clad, totally enclosed, rigid, floor mounted, air-insulated, cubicle type suitable for operation on three phase 415 volts, 50Hz.
- The panel shall be installed outside, therefore it shall have protection of IP65 or better.
- All the 415V AC devices/ equipment like bus support insulators, switches, SPDs, etc mounted inside the switchgear shall be suitable for continuous operation and satisfactory performance under the following supply conditions:
  - Variation in supply voltage: +/- 10%
  - Variation in supply frequency: +/- 2 Hz
- The ratings and types of equipment inside the LV ACDB shall be as per the electrical drawing and latest technology.

9. HT Bidirectional Tri-Vectors Energy Meters

- Design, engineering, manufacture and supply of bi-directional tri-vector type energy meter(s) for recording data regarding export and import of power to/from BPC's grid and also recording KVAH & KVARH data on real time basis.

10. 11kV Outdoor ICOG VCB Panel Board

10.1 Applicable Standards

Except where modified by this specification, the circuit breakers and the accessories shall be designed, manufactured and tested in accordance with latest editions of the following standards:

Sl. No	IEC/ISO/BS Codes	IS Codes	Subject
1	IEC: 56, IEC: 62271-100&200	IS: 13118	High voltage alternating current circuit breakers general requirement.
2	IEC: 694	IS: 12729	Common clauses of high voltahe switch-gear and control gear standards (for voltage exceeding 1000V)
3	IEC: 60	IS: 9135	High voltage testing techniques
4	IEC: 427	IS: 13516	Method of synthetic testing of HV AC circuit breakers.
5	IEC: 1233		HV AC Circuit breakers - inductive load switching.
6	IEC:17A/ CD:474		HV AC Circuit breakers - capacitive switching.
7	IEC: 529	IS: 13947	Degree of protection provided by enclosure.
8	IEC: 137	IS: 2099	Insulating bushing for AC voltages above 1000V
9	IEC: 233	IS: 5621	Hollow insulators for use in electrical equipment and testing.
10	IEC: 273	IS: 5350	Characteristics of indoor and outdoor post insulators for systems with nominal voltage greater than 1000V
11	IEC: 815	IS: 13134	Guide for selection of insulators in respect of polluted conditions.
12	IEC: 34	IS: 996	AC Motors
13	ISO: 1460 BS:729	IS: 2629	Hot dip galvanizing
14		IS: 2633	Method of testing uniformity of zinc coated articles.
15		IS: 5	Color for ready missed paints and enamels.
16		IS: 6005	Code of practice for phosphating of iron and steel.
17	IEC: 227	IS: 1554 / IS:694	PVC insulated cables for voltages up to and including 1100 volt.
18	IEC: 269	IS: 13703	Low voltage fuses for voltages not exceeding 1000 volts.
19	IEC: 800	IS: 13118	Phenolic moulding materials
20		IS: 13118	Guide for uniform marking and identification of conductors and apparatus terminals.
21	IEC: 185	IS: 2705	Current transformer
22	IEC: 296	IS: 335	Specification for unused insulating oil for transformer and switchgear.
23	IEC: 186	IS: 3156	Potential transformers
24		IS: 3427	AC metal enclosed switchgear and control gear for rated voltages above 1kV and upto and including 52kV
25		IS: 5578	Guide for marking of insulated conductors
26		IS: 3231 (1965)	Specification for electrical relays for power system protection
27		IS: 4710	Switches and switch isolators above 1000V but not exceeding 11000V
28		IS: 1818	Alternating current isolators (Disconnections) and earthing switches
29		IS: 9385	High voltage fuses

30		IS: 1248 (Part-1)(1993)	Direct acting indicating analogue electrical measuring instruments and their accessories: General requirements.
31		IS: 2208	HRC Cartridge fuses links upto 650V
32		IS: 6875	Control switches and Push buttons
33		IS: 722	Integrating Meters
34		IS: 2147 (1962)	Degrees of protection provided by enclosures for low voltage switchgears and control gear.

10.2 Constructional requirements

- Switchgear shall comprise of indoor, metal enclosed, fully draw out, Vacuum circuit breaker panel as specified in data sheet.
- Switchgear shall be dust, moisture and vermin proof.
- Switchgear shall be suitable for 3 phase, solidly earthed AC system. Supply voltage, rated current and system fault level shall be as per enclosed data sheet.
- All doors, panels, removable covers inter panel coupling shall be gasket all around with neoprene gaskets. All louvers shall have screens and filters.
- Metal enclosed unit shall comprise of rigid welded structural frame enclosed by 2.5mm thick cold rolled metal sheets. Structural framework with foundation/ fixing bolts, etc. shall be provided at the bottom to mount switchgear directly on concrete/ steel channel base.
- Switchgear shall be fully compartmentalised. Separate segregated compartments of metal partitions shall be provided for breakers, isolators, switch fuses instruments/ relays, buses/ CT/ PT and cable boxes.
- Cable entry shall be from bottom. Switchgear cubicles shall be provided with 3 mm thick, undrilled, removable cable gland plate, cable glands, cable boxes/pot heads and cable lugs. All material such as compound, tapes, binding wires, clamp, etc. ate included in the scope of supply.
- Switchgear construction and components shall be such that future extension shall be possible on either side.
- Separate labels shall be provided for switchgear, cubicles, relays, instrument, switch etc. One danger board in the front and back shall also be provided. All components mounted inside the panel shall be with identification nameplate.
- Painting (Confirming to IS: 5, 1994) shall include emulsion cleaning, pickling with dilute acid, washing and rinsing by water, phosphate and oven drying. One (1) coat of epoxy based zinc chromate primer and two (2) coats of epoxy paint of approved shade shall be applied.
- Separate explosion vents shall be provided on top covers for each circuit breaker, isolator, switch fuse, bus bar and cable chamber.
- Suitable fire barriers shall be provided between bus- sections of adjacent panels.
- Name plates shall be of anodised aluminium or approved design. Letter shall be in white colour, rear engraved on black background.
- Inter compartment wiring shall be routed through the PVC/Metallic flexible conduits.
- All high voltage parts shall be maintenance free.
- Without opening the door of Breaker compartment, draw out unit shall be moved.

10.3 Safety Interlock and Features

- It shall be possible to withdraw or engage breaker only in open position.
- Compartment door / front part of the truck of breaker, isolator, and switch fuse shall not open unless associated breaker or switch is in open position and vice versa.
- Safety shutters automatically operated by movement of breaker/ switch carriage to cover live parts when carriage is withdrawn or draw in / out shall be provided.
- It shall not be possible to switch on the breaker when the breaker truck is in any position between test and service position.
- It shall not be possible to disconnect the low voltage plug and socket connector for control, instrumentation & interlock circuit in any position except test/ isolated position.
- It shall be possible to move the breaker truck inside the panel only when the LT plug and socket is connected.
- Safety shutter shall be of metallic/FRP (Flame Retardant) sheets.
- Switchgears shall be equipped with pressure reducing covers (on top) in each Compartment and shall be equipped with screens.
- Effective interlocks shall prevent malfunction even when a failure of the power supply occurs.
- Earth switch should be able to close only when breaker is isolated position.
- Mechanical castle key interlock shall also be provided.
- It shall not be possible to switch ON the breaker when the rear door of HT panel is not closed properly or in open position
- It shall be possible to withdraw or engage breaker (rack IN/OUT) in case of failure of AC/DC supply.

10.4 Main Bus Bars & Supports

- Main bus bar shall be of uniform cross section of copper or copper alloy confirming to BS 159:1992
- All bus bar joints or bus tap joints shall be silver faced. Wherever aluminium to copper connections is required suitable bimetallic connectors/ clamps shall be used.
- Maximum temperature of bus bars and bus connections shall not exceed 85° C.
- Bus bars shall be air insulated, supported on cast resin insulators of switchgear rated voltage class and phase segregated by means of non-hygroscopic insulating phase barriers.
- Bus bar shall be heat shrinkable type PVC sleeved of Switchgear voltage grade and shall be colour coded.
- Short circuit withstand capacity shall be provided as specified in data sheet.
- They shall also take care of any thermal expansion.
- Two bolt connections with plain spring washers and locknuts shall be provided for ensuring Good contacts at the joints & taps.
- Insulator shall have total and protected creep age distance as per voltage class.
- Insulators shall be spaced at suitable interval to withstand the short circuit forces in the event of fault.
- Separate insulators for supporting the bus-bars shall be provided for each phases.

10.5 Circuit Breaker

- Circuit breaker poles shall be operated by a common shaft. Operation counter shall be provided.
- Circuit breaker with its operating mechanism shall be mounted on a shielded carriage moving on guides designed to align correctly and allow easy movements. Isolating plugs and sockets for power and control circuit shall be robust, fully self-aligning and shall be silver faced. Insulating shrouds of PVC or other insulating materials shall be provided.
- There shall be `Service ', 'Test' ' and 'Fully withdrawn' positions for breaker.
- Vacuum circuit breaker shall consist of air insulated poles incorporating the vacuum interrupters and mechanism housing. The operating mechanism shall be connected to the moving contacts through insulated couplers. The entire construction shall be sturdy and designed to withstand the mechanical and electrical stresses, which may be encountered both during normal operation and short circuit conditions. Suitable arrangement shall be provided to check the contact wear & tear.
- Operating mechanism shall be non-pumping electrically and mechanically.
- When breaker is already closed, failure of any auxiliary spring shall not prevent tripping and shall not cause damage to the breaker or endanger the operator.
- A mechanical OPEN/CLOSE position indicator visible with closed door shall be provided.
- Mechanical trip and close devices shall be provided. Access to mechanical closing device shall be only after opening the cubicle door / operating the lever.
  Circuit Breaker shall be provided with Motor wound spring charging mechanism, Complete with motor. Spring charging motor shall preferably be a universal motor. Motor shall be used solely for storing energy in the spring - and not for direct closing of the Breaker. Limit Switch shall be provided to cut-off the motor power, when the spring is charged fully, with a contact for spring charged indication lamp on the panel. Also, mechanical indication for spring charged/Discharged shall be provided.
  Breaker shall have facility to charge the spring by the manual spring charging handle. It should be ensured that whilst manual spring charging is in operation, Electrical power to the spring charging motor shall be cut off, automatically.

- The following accessories shall be provided for individual panel:
  a. Aux. Switch with 11NO+11NC contacts
  b. Closing Solenoid
  c. Tripping Solenoid
  d. Mechanical Operation Counter
  e. Spring Charging Handle
  f. Shunt Release
  g. Spring Charged / Discharged Indication
  h. Electrical Local Closing

- All measuring Control protection units, signal lamps and so on shall be mounted in front of the panels.
- Mechanical Indication of breaker position while door is closed (like service, test, isolated)

- Circuit Breaker shall be conforming to IEC: 56, IEC: 62271-100&200 or IS: 13118 (1991) standard.

10.6 Earthing

- An earthing bus extending throughout the length of the switchgear shall be provided.
- Two separate earthing terminals shall be provided in each panel and shall be connected to the earth bus within the panel. The earthing conductor on the primary equipment as well as for external connection to substation earthing grid shall be adequate to carry the rated switchgear short-circuit current of 26.3 kA for 1 second as per IS 3043.
- All non-current carrying metal parts shall be effectively bonded to the earth bus.
- In the case of draw out type breaker / switch fuse units withdraw truck shall be connected to the earth when the breaker is in isolated position and shall remain connected to the panel earth till the truck has moved past the isolated position during withdrawal.
- All the Breaker trolley shall have earthing arrangement, such that whilst trolley is racked in-side the panel, it should first get earthed, thereafter the line parts of the Breaker poles comes in contact & vice-versa while removing the trolley from the panel.

10.7 Cubicle Accessories and Wiring

10.7.1 Wiring

- Cubicle internal wiring and inter panel wiring shall be carried out with 1.5 mm2 copper conductor PVC flexible wire for control circuits and with 2.5 mm2 copper conductor wires for CT circuits. Wiring of AC and DC shall be colour coded and terminated on separate terminal blocks. Ferrules shall be provided on each wire.

10.7.2 The following accessories shall be provided

- MCB of suitable rating for auxiliary A.C & D.C supply.
- Separate 650 V grade terminal blocks of polycarbonate type including 20% spare terminals for AC and DC auxiliary supply for control and instrument wiring.
- Cubicle space heater along with switch fuse & thermostat control.
- A Plug & Socket controlled by switch.
- One set of tools required for operation and maintenance shall be supplied along with switch-gear.
- Cubicle illuminating lamp CFL/FTL with control switch and door limit switch in the instrument chamber.
- All spare contact of Relays/Breaker, Aux. contacts etc. shall be wired up to the Terminal Block, such that same can be used as and when required.
- One set of tools, required for operation & maintenance shall be supplied for switchgear.

10.8 Instrument Transformer

- CT and PT shall conform to the IEC and IS standard codes mentioned in the aforementioned table. The ratings specified are indicative only and it shall be vendor's responsibility to ensure that the ratings are adequate for relays/ meter application considering lead resistance etc.
- CTs / PTs shall be of cast resin type.
- CT terminal shorting links shall be provided at terminal blocks.
- PT shall be provided with adequately rated primary and secondary fuses.

- PT shall be of draw out type, unless specified. Line PT shall have separate enclosure mounted on rear or front side of the Panel whichever is suitable for compactness of panel or easy maintenance or both.
- Primary neutral of the PT shall be effectively bonded to earth.

10.9 Instruments

- Load Manager / Indicating instruments shall be provided for measurements of voltage, amperes, kW, frequency, kWH, maximum demand and power factor as specified in enclosed drawing. Multi-cluster LED type lamp of 22.5 mm. Diameter shall be provided for indication of various parameter of circuit breaker viz. Circuit Breaker "ON", "OFF", Trip, spring charged, R-Y-B Potential indication, Trip coil healthy, etc.
- Test Terminal Blocks for metering circuit of current Transformer & PT shall be provided.
- Approved means shall be provided for zero adjustment from front without dismantling the instruments.
- Fuses and links shall be provided for isolation of individual circuit from bus-wires disturbing the other circuit equipment.
- Terminal blocks shall be of shorting and disconnecting type.
- Each wire shall be identified at both ends with wire designation number by plastic ferrules preferably interlock type. A wire termination shall be made with the compression type connectors.

10.10 Relays

- Relays shall be suitable for flush mounting with connection from rear. Protective relays shall be in draw out case.
- Protective relays and timers shall be provided with hand reset contacts and shall be provided with flag to indicate the operation of relays.
- The equipment shall have protective scheme with the following relays:
    - Triple pole IDMTL type combined over current (2 Nos) and Earth fault (1 No) relay (Draw out type) preferably non-communicable numerical relay.
      Plug setting range of the overcurrent and earth fault relays shall be 5% to 250%.
    - Auxiliary relay for transformer fault and winding temperature.
    - Master trip relay for inter tripping
    - Differential relay
    - One alarm bell scheme with bell (24V DC)

  N.B: The relays should be of reputed make acceptable to the employer.

10.11 Communication Feature

- As a minimum one independent RS 232, one RS 485 communication ports and one Ethernet communication port that allow for simultaneous operation shall be provided to be used as follows:
    - For relay setting, modification, extraction and analysis of faults / events / disturbance records from laptop through RS 232 at the front.
    - To interface with remote communication equipment for SCADA.
- The remote communication protocol of the numerical relays shall be IEC 61850.
- The relays should generate GOOSE messages as per IEC 61850 standard for interlocking and also ensure interoperability with other relays.

- Necessary user friendly configuration tool shall be provided to configure the relays; it should be SCL/SCD files generated by other system.
- Goose signal should be freely configurable for any kind of signal using graphic tools / user friendly software without use of any external software.
- Suitable arrangement to be provided to monitor the following conditions of 11kV VCB at SCADA Control Centre end :
    - DC healthy
    - Breaker is OFF‘
    - Breaker is ON‘
    - Spring for closing mechanism is charged
    - Breaker is in Local
    - Breaker is in Remote
    - Trip Circuit healthy
    - Breaker is not anti-pumping
    - Tripping due to O/C
    - Tripping due to E/F

10.12 Miscellaneous Accessories

- Breaker control switch shall be spring return to neutral type with pistol grip handle, provided with lost motion and sequencing device and lockable in neutral position.
- Indicating lamps shall be of neon filament type with suitable series resistor and translucent lamp covers and lamps shall be replaceable from front.
- Push buttons shall be of momentary contact type rated for 10A at 500V AC. The colour of push buttons shall be as follows:
    - Start - Green
    - Stop - Red
    - All other – Black
- Alarm Annunciators
- Alarm annunciators shall be provided, if specified in data sheet.
- Alarm annunciator shall comprise of flush mounted facia units with two lamps and series resistor and ground glass plate in front of inscriptions.
- Alarm annunciation scheme shall include facia units with relay for each fault, a common alarm bell, `Accept '/ `Reset '/ `Test ' push buttons.
- The alarm annunciation scheme shall operate as follows:

Condition	Visual	Audible
Normal	Off	Off
On occurrence of fault	Flashing	On
Accept fault	Steady	Off
Reset-fault Cleared	Off	Off
Reset fault not Cleared	Steady	Off
Lamp test	Steady	Off
Annunciation test	Steady	On

10.13 Tests

- Routine tests shall be carried out on all components as per relevant standards.
- Three (3) copies of test certificate shall be submitted for Employer’s approval before despatch of switchgear.

- Three (3) sets of Test certificates of all bought out items supplied along with the panel, viz. Relay, CT, VT, Meters etc. shall also be submitted.
- Employer reserves the right to witness the following routine test on switchgear/ components mounted in switchgear:
    i. Operational Test (Electrical & Mechanical) of Circuit Breaker.
    ii. Primary/Secondary current injection test to check the operation of Meters and relays. Simulating actual operational conditions to check the operation of circuit breaker, indicating lamp, interlocks etc.
    iii. Pick-up & Drop-off voltage test for shunt trip and closing coil.
    iv. Current Transformers Polarity Test
    v. Voltage Ratio Test for Voltage Transformers.
    vi. Insulation Resistance Test of Power & Control Circuit, before and after High voltage Test.
    vii. High Voltage Test on Power and Control Circuit.
    viii. Earth continuity Test, with low voltage tester.
    ix. Physical dimensional check as per the approved drawing and visual inspection of the switch gear.
    x. Circuit Breaker contact opening & closing time at rated voltage, at 70 to 110% of rated voltage and also synchronous operation test.
- Millivolt drop test of circuit breaker.

10.14 Guarantee

- The contractor shall Guarantee Design, Materials / Workmanship and Performance of equipment supplied for a period of twelve (12) months from the date of commissioning & handing over the installation to the owner, duly certified by the site in-charge / owners representative for satisfactory operation of the equipment.

10.15 Drawings and Instruction Manuals

- Contractor shall submit four (4) sets of the following drawings for approval after award of contract:
    i. Complete assembly drawing of Switchgear showing plan, elevation, typical section with dimensions and location of terminal blocks for external connections.
    ii. Schematic diagrams with terminal and ferrule numbers for each module.
    iii. Wiring diagram for each module indicating terminal blocks and various apparatus.
    iv. Final list of apparatus for each type, fuse and thermal overload relays.
    v. Characteristic curves for circuit breaker releases, relays of each type, fuse and thermal overload relays.
    vi. Manufacturer's descriptive literature on various components used in switchboard.
    vii. One print of each drawing will be returned to contractor after making all necessary corrections, changes and required clarifications. Vendor shall incorporate these and send within fifteen days, four (4) prints of each drawing marked "Certified for record and use". Manufacture of VCB Panel shall be taken up only after the approval of the drawings.
    viii. Contractor shall submit four (4) copies of "Installation & Instruction" manual.

ix. Four (4) copies of type test and routine test certificates shall be submitted for Employer's approval before dispatch of switchgear.
x. Contractor shall also submit one (1) set of CDs each to client and MM containing all drawings in CAD and data in MS office.
xi. Contractor shall furnish Drawing data sheet and catalogues along with bid.

10.16 Technical Datasheet

Sl. No	Description	Specification	Unit
1	General		
	Switchgear Designation	M.V. Switchgear Panel Out-door type	
	Installation	Floor Mounted, Outdoor type	
	Protection degree	IP65	
	Governing Standards	IS: 13118, IEC-62271-100	
	No. of poles of circuit breaker	3	no.
	No. of breaks per phase	1	no.
	Total length of break per phase	8 ± 1	
	Type	Vacuum	
	Rated voltage	11	kV
	Maximum (continuous) service rated voltage	12	kV
	Basic insulation level	28/75	kVrms/kVp
	Rated Frequency	50	Hz
	Rated Busbar current	630	A
	Short time current rating	20	kA
	Duration	1	Sec
2	Vacuum Circuit Breaker		
	Rated voltage	12	kV
	Insulation level	28/75	kVrms/kVp
	Rated Current	630	A
	Breaking Capacity	20	kA
	Making Capacity	50	kA
	Opening time	<60	ms
	Arc duration	<15	ms
	Total interruption time	<60	ms
	Closing time	<80	ms
	Operating temperation	(-)5 to (+)40	deg.C
	Electromagnetic compatibility	As per IEC 60694	
3	Operating mechanism		
	Operating sequence	O-0.3s-CO-3min-CO	
	Opening type	shunt type	
	Closing type	Motor/ Manual spring charge, Shunt/ Magnetic actuator operation	
	Time taken by motor for charging the spring from fully discharged to fully charged position	<30	sec
	Weather anti-pumping device provided	Yes	

4	Auxiliary and Control Power Supply		
	Normal auxiliary AC supply voltage	230	volts
	Voltage limits for proper operation		
	Maximum	115%	volts
	Minimum	85%	volts
	Frequency limits for proper operation		
	Maximum	105%	Hz
	Minimum	95%	Hz
	Normal control circuit voltage	24	volts
	DC voltage limits for proper operation		
	Maximum	120%	volts
	Minimum	70%	volts
	Power required for trip coil	300	watts
	Power required for trip coil	300	watts
5	Circuit Transformer		
5.1	Category A: 600-300-150/1-1-1A		
	Make and type of transformer	Out type, 1ph, oil colled, Dead tank	
	Ratio	600-300-150/1-1-1A	
	Core 1.		
	VA burden	15	VA
	Accuracy class	0.5	
	Instrument security factor	10	
	Core 2.		
	VA burden	15	VA
	Accuracy class	5P	
	Accuracy limit factor	20	
	Core 3.		
	Accuracy class	PS	
	Knee point voltage (Vk)	>=150	volts
	Magnetizing current at Vk/2	<30 mA at 0.5 Vk	Milli Amps
	Short time current rating, time	20kA for 3 sec	kA / sec.
	Impulse voltae withstand level	75	kV
	Power frequency voltage withstand level		
	Primary winding	28	kV
	Secondary winding	3	kV
5.2	Category B: 400-200-100/1-1A		
	Make and type of transformer	Out type, 1ph, oil colled, Dead tank	
	Core 1.		
	VA burden	15	VA
	Accuracy class	0.5	
	Instrument security factor	10	
	Core 2.		
	VA burden	15	VA
	Accuracy class	5P	
	Accuracy limit factor	20	
	Short time current rating, time	20kA for 3 sec	kA / sec.

	Impulse voltae withstand level	75	kV
	Power frequency voltage withstand level		
	Primary winding	28	kV
	Secondary winding	3	kV
6	11 kV Voltage Transformer		
6.1	General		
	Make and type of transformer	Out type, 1ph, oil colled, Dead tank	
	Rated normal voltage	11/√3	kV
	Rated maximum voltage	12/√3	kV
	Rated primary voltage	11/√3	kV
	Rated secondary voltage	110/√3	volts
	VA burden	100	VA
	Accuracy class	0.5	
	Impule voltage withstand voltage	75	kVp
	One minute power frequency voltage withstand level of primary winding	28	kV
	Rated Voltage factor		
	Continuous	1.2	
	For 30 seconds	1.5	
6.2	Core		
	Flux density at normal voltage and frequency	<1.2	Tesla
	Lamination thickness	0.27	mm
6.3	Windings		
	Purity of copper used	Electrolytic	
	Power frequency voltage withstand level		
	Secondary winding to earth	3	kV
	Primary winding to earth	28	kV
6.4	Secondary terminal Box		
	Degree of protection		
	Vermin proof provision	Yes	
	Weather proof provision	Yes	
	Dust proof provision	Yes	
	Thickness of metal used	3	mm
6.5	HV Terminal		
	Bimetallic	Yes	
	Size and type of conductor it can accommodate	150	sq.mm
7	Instruments & Meters (Ammeter, Voltmeter & Energy Meter)		
7.1	Type & make of ammeter and voltmeter	Analogue type	
	Size	144 x 144	mm
	Whether magentically shield or not	Yes	
	Limits or error in the effective range	±2%	
	Scale length	90 Deg.	
	Short time overload rating	200%	

7.2	Energy Meter Type	11kV Trivector 3 ph meter with communication (Modbus RS485 provision)	
8	Protective Relays		
	Type	Numerical	
	Auxiliary supply	24V DC	
9	Power Packs (2 X 12 V inbuild Battery)		
	Rated AC voltage	230	volts
	Phase	Single phase	
	Capacity	300	VA
	Type of rectification employed	Full wave	
	Type of rectification connection	Bridge	
	Output DC voltage	24	volts
	No of closing and trippong taken by this pack	>10	

11. 250kVA 0.415/11kV Dry-Type Step-up Power Transformer

11.1 Standards:

Transformers covered by this specification shall, unless otherwise specified by built to conform Indian Electricity Rules, wherever, applicable and other ISS as mentioned below:

Sl. No	IEC/ BS/ ISO	IEE	IS	Subject
1			IS 2026 (Part 1 to V)	Distribution Transformers
2	IEC 60076	IEE C57.12.01-1988	IS 11171	Dry type transformer
3			IS 12063	Degree of protection provided by enclosures
4			IS 3347	Porcelain Transformer Bushing
5			IS 5, IS 104 & IS 2932	Colour shade and colours for ready mixed paint and enamels
6	IEC 60726			Power transformers- insulation levels, dielectric tests and external clearences in air
7	IEC 60905			Loading guide for dry type transformers
8	BS 171			Power transformers specification for insulation levels and dielectric test

In the event of a conflict between the above standard and specification, the latter shall govern.

11.2 Rating and central data for Dry type Power Transformer

- Core type three phase dry type step up two winding power transformer complying with the standard codes mentioned above.
- Rating: 250kVA
- Number of phase: Three
- Frequency: 50 Hz
- Type of cooling: ANAN
- Voltage Ratio: 0.415/11 kV
- Vector Group reference: Dyn11
- Category: Dry, Air Cooled, fully encapsulated, Outdoor, Cast Resin
- Enclodure Protection Degree: IP65 or better Outdoor type
- Percentage Impedance 5%

11.3 Connections:

- The primary (LV) winding shall be connected in delta and the secondary (HV) winding in star with vector group Dyn11. The neutral of the primary (LV) winding shall be brought out to a separate insulated Bushing.
- The size (cross section) of the neutral connection conductors and jumpers must be of same size as that of phase connecting conductors and jumpers which shall be properly supported and insulated.

11.4 Terminal Arrangement:

i. HT Side Cable Box
The H.V. cable end box with 3P-1G air filled non-magnetic gland plate should be suitable for termination of 3 core 150 sq. mm 12KV grade XLPE cable. The cable holding clamp is to be provided. Necessary drawing is to be provided. Necessary drawing is to be furnished in this regard.

ii. LT Side Cable Box
The L.T cable end box with 4P-2G air filled gland should be suitable for termination of 3 sets of 4 core 240 sq. mm XLPE cable for 250 KVA Transformer. The cable holding clamp is to be provided. Necessary drawing is to be furnished in this connection. Size of L.T. cable end box with non-magnetic gland plate suitable for termination of 250 KVA Transformer shall have to be furnished by the manufacturer during submission of drawing. Bus Duct of copper of adequate cross section of suitably mounted and insulated may also be provided, if termination arrangement requires bus duct.

iii. All flexible of H.T. & L.T. sides should be connected with pressure plates of area equal to the end of the flexible, flat & spring washers, pressure plates with suitable fasteners, flat washers and spring washers should be provided with HV terminal clamps (inside the cable boxes) and pressure plates 16 mm fasteners with plain and spring washers should be provided with LV terminals.

iv. The cable gland should be of brass and provided with cable armour holding clamps.

v. HT terminal for cable connections shall be brought out through sidewall mounted Bushing to a cable end box.

vi. Cable end box shall be self-supporting, weatherproof, air filled type with sufficient space inside for termination and connection of cable.

vii. Cable end box shall be furnished complete with removal gland plate, double compression brass gland.

viii. In general, the arrangement shall be such as to permit removal of core & coil assembly without dismantling the cable installation.
   a. Suitable arrangement for HV side box and LV side box shall be provided. The LV cable box shall be suitable for terminating the cable, if provided, which will approach the boxes vertically from the bottom. The cable box shall be suitable for being detached from the main body with suitable mounting arrangement. The HV and LV cable box shall be fixed on the opposite sides and the portion of those boxes other than the minimum area required for specific termination of the H.V. and L.V. terminals shall be kept projected from the main tank enclosures so that natural air circulation does get hindered to a minimum due to placement of the Cable End Box.
   b. The HT & LT cable box shall be fixed on the opposite sides.

ix. Cable gland suitable for HT/LT cable box shall be provided as follows:
   a. Cable size for HT: 3 Core x 150sq.mm. XLPE cable of 12kV grade
   b. Cable size for LT: 4 Core x 240sq.mm. PVC armoured 11kV grade cable

11.5 Leads:

- All leads of the windings, connection of the windings or their wires to one another to terminal bushing properly insulated and covered with insulation sleeves. The Brazing materials shall have higher melting temperature above 300 ^{0}c and preferably above 400 ^{0}c for better thermal endurance and mechanical strength. The tenderer shall specifically mention the method and materials to be used by them for lead connection.

11.6 Conductors: Copper

11.7 Tap Changing Arrangement: Tap changing arrangement is not required.

11.8 Enclosure and fitments

- The enclosure & fitments shall be of CRCA pressed and shaped sheet steel having low loss and good grain properties, coated with insulation, bolted together to the frames firmly to prevent vibration or noise. The purpose of having the enclosure is to provide safety from live parts , protect and prevent ingress of foreign particles rain water , vermin , rodent, outside dust & against ingress of splashing of water etc. as per **IP 65 or better** for outdoor use. The enclosure shall have structural steel frame work with lockable hinged door on HV and LV terminal sides. The gasketted doors shall facilitate the inspection of transformer.
- The CRCA sheet steel thickness shall be not less than 3.0 mm for structural members and 3.0 mm for all doors/covers etc. If corrugated sheet is used then the sheet thickness shall not be less than 1.2mm.
- The enclosure shall not have degree of protection less than IP 65 or better for outdoor installations

The fitments shall comprise the following:

- Cowl type inspection cover is to be provided on a raised boss on the top plate at a suitable position for getting access to HV & LV risers as well as HV tapping links inside the tank.
- Two drain plugs should be fitted at the bottom of the transformer enclosure to drain out water, accumulated due to humid deposition or seepage.
- Ports should be provided in core & winding for inserting temperature measuring transducers.
- Lifting hooks on top cover of the main tank
- Diagram and rating plate, Danger Plate
- 4(Four) nos. Lifting lugs.
- Two earthing terminals
- Skid channels with rounded corners to be provided along the width of the transformer with hole centers at 457mm (18φ) at the centre of gravity of the whole transformer. Open side of the channels should be outwards.
- Explosion Vent-Two nos. explosion vents should be provided on main tank top copper to be shown in the General Arrangement Drawing. The area of each vent shall be 75 mm x 50 mm approx.
- The sheet thickness of different parts of the transformer are as provided below:
  - **i.** LV cable box : 3.15 mm

ii. LV door leaf : 3.15 mm
iii. HV cable box : 3.15 mm
iv. HV door leaf : 3.15 mm

11.9 Core

- The magnetic core shall be built of very low loss Silicon steel, cold rolled grain oriented steel. Core should be of stack core type.
- The materials used for insulating the sheets, shall have high interlamination resistance and rust inhibiting property. It shall not be deteriorated by ageing from hottest operating temperature and clamped pressure of the core disintegrated due to mechanical modes of core vibration. It shall not have the least tendency to absorb moisture, or to react with the moisture present in the air thus accelerating deterioration of insulation.
- The assembled core shall be securely clamped in the lines and in the uniform pressure so as to minimize the noise from the core.
- Core Clamping-The core-clamping frame shall be provided with lifting eyes for the purpose of lifting/shifting. The whole core shall be electrically connected by copper strip of adequate section to the core frame at two separate points for being eventually earthed through the tank to drain off electrostatic potential that may be built up.
  Core base and top and bottom of yoke shall be supported with M.S. channel of proper size and properly bolted together for stack type core.
- Flux density- Flux density in any part of the core and yoke at rated voltage & frequency shall be 1.69Tesla.
  The maximum flux density in any part of the core and yoke shall not exceed 1.9 Tesla.
- All core clamping bolts shall be effectively insulated.
- Adequate provision shall be made to prevent movement of the core and winding relative to the enclosure during transport and installation or while in service.
- The core shall conform to: IS: 3024-1965. Electrical Sheet Steel & IS: 649 – 1983 method of test and steel sheet.
- Core insulation- Class ‘C’ grade insulation paper of thickness 20 mils (0.5mm) shall be used and make should be clearly stated in the offer along with test certificates.

11.10 Windings

- Transformer shall be provided with the requisite number of windings (as detailed hereunder) and shall be designed to withstand the electromechanical stress exerted under short circuit conditions as per ISS: 2026 -1977. Class ‘C’ Insulation shall be used. The winding of Dry Type transformer will be encapsulated.
- Construction details:
  HV & LV Coils
  i. Active Material - Electrolytic copper conductor.
  ii. H.V. Winding - Nomex insulated round conductor.
  iii. HV - Multiple rectangular copper strip with Nomex inter – layer insulation to achieve best short circuit withstand capability. LV -= Copper strip/foil of spiral type.
  iv. Coil Insulation-Insulated with Nomex and glass tape.
  v. Coil spacers & Supports-High Temp. Epoxy fiber glass.
- The insulation level of the Windings shall be as follows as per IS: 11171 –1985 or CEA guideline.

Voltage	Impulse Voltage	Short duration Power frequency voltage
415V	-	3kV
11 kV	75 kV	28kV

- The winding shall be so designed to reduce to a minimum the out of balance forces in the Transformer (at all voltage ratios).
- Bracing of Windings:
  i. The windings and connections of all transformers shall be braced to withstand shocks which may occur during transport or due to switching short circuit and other transient conditions during service.
  ii. Coil clamping rings, if provided, shall be of steel or of suitable insulating material.
  iii. The winding shall be assembled on the core co-axially for magnetic balance and symmetrically for electrical balance. Spacers, wedges shall be robust, hard insulations are so fitted in the winding so that they will neither move nor permit any relative movement of any part of the winding during normal service and under a terminal short circuit, not mechanically injure any insulation in the windings.

11.11 Overloads:

- Dry type AN cooled transformer, can be overloaded according to IEC 60905 Loading guide for dry type transformers.

11.12 Bushing:

- For 11 KV, 12 KV Bushing will be used and for 415 volts, 1.1 KV Bushing shall be used. Bushing of same voltage class shall be interchangeable.
- Standard practices for Bushing as per IS 347 amended up to date shall be mounted on the side of the enclosure and not on the top cover.

Voltage Class	Indian Standards	
	For Porcelain Parts	**For Metal Parts**
Upto 11kV Bushing	IS: 3347/ Part-I (sec-1)(1979)	IS: 3347/ Part-I (sec-2) (1979)

- The clearances in air between live and conductive parts and live conductive part to earthed structures shall be as follows in cable end box:

Nominal System Voltage (kV RMS)	Test Voltage Impulse (kVp)	Phase to Phase (mm)	Phase to Earth (mm)
0.415	NIL	45 mm. addition clearance after fitment of socket suitable for 4 core 240 sq.mm. LT power cable	20mm. Additional clearance after fitment of socket suitable for 4 core 240sq.mm LT Power cable
11	75	130 mm. additional clearance after fitment of socket suitable for 3 core 150sq.mm HT power cable of 12kV grade	80 mm. additional clearance after fitment of socket suitable for 3 core 150sq.mm HT power cable of 12kV grade

** In LT side Copper/Aluminum Bus Bar on suitable fixture and of suitable size (150 mm x 8 mm) to be provided.

11.13 Cooling Arrangement

- The transformer shall be suitable for loading of 100% continuous maximum rating with 'ANAN' cooling without exceeding the thermal limit.
- Painting:
    - The surface to be painted shall be completely cleaned & made free from all rust, scale or foreign adhering matter of grease.
    - After thorough metal treatment enclosure surface shall be given a primary coat of Zinc chromate and two coats of dark admiral gray (IS 104 & IS 2932) enamel / powder paint. Double coat of corrosion resistant primer shall be applied before painting. The inside of the enclosure shall have semi glossy paint finish. All metal parts not accessible for painting shall be made of corrosion resistant material. All steel surface exposed to weather, shall be given a primary coat of Zinc chromate and two coats of dark admiral gray paints.(IS 104 & IS 2932)
    - All paints shall be carefully selected to withstand tropical heat and extremities of weather. The paint shall not scale off or winkle or be removed by abrasion due to normal handling.
    - All nuts and bolts used in the Transformer for external fittings shall be galvanized or zinc passivated and painted with body paint.

11.14 Test & Inspection

- **Routine Test:**

  All Transformers shall be subject to routine tests at the manufacturers Works. The following tests are to be carried out:

  i. Measurement of winding resistance.
  ii. Ratio, polarity and Vector Group test
  iii. % Impedance voltage at Principal Tap position at 50 Hz & 75°C.
  iv. No load loss at 50Hz.
  v. Load Loss at 75°C at 50% loading.
  vi. Load Loss at 75°C at 100% loading
  vii. Insulation resistance.
  viii. Induced over voltage withstand
  ix. Separate source voltage withstands
  x. Unbalance current: The maximum value of unbalance current in Transformer shall not exceed 2% of full load current as per CBIP manual for Transformer.
  xi. Magnetizing current at rated voltage & frequency and 110% of rated voltage & frequency.
  xii. Temperature rise test will be conducted on one transformer against every Order for inspection. The temperature rise test will be performed on lowest tap at appropriate current related to the said tapping with total losses fed corresponding to minm. Voltage tapping as per IS 2026 (Part-2) 1977, amendment no.2, 1984.

- **Type and Special Test**
  - **i.** Lightning Impulse withstand test, Temperature Rise Test, Dynamic Short Circuit withstand test and Measurement of acoustic sound level test report from CPRI/NABL Accredited laboratory, carried out within five years.
  - **ii.** The transformer during Dynamic Short Circuit Test shall not exhibit more than 2 percent variation in percentage reactance.
  - **iii.** Temperature rise Test.

11.15 Contract Drawing:

- The General Assembly outline drawing giving detail of dimensions and fittings should be submitted for the Transformer.
- Name & Rating Plate drawing
- Internal assembly drawing
- Terminal arrangement drawing.
- H.V. & L.V. cable box drawing

11.16 Overload Capacity:

- Transformer shall be capable of carrying sustained over load as stated in International codes and standards.

11.17 Over Fluxing:

- Over fluxing in the core shall be limited to 12.5% so that the flux density in the core does not exceed (19000 lines/sq.cm.)
- The maximum flux density in any part of the core under such condition shall not exceed 19000 lines/sq.cm on the basis of M4,M5 & M6 grades as per BS 601: Part-2:1973(Specification for sheet and for magnetic core of electrical apparatus oriented Steel).

11.18 Internal Earthing Arrangement:

- All metal parts of the Transformer with the exception of the individual core laminations, core associated damping plates shall be maintained at some fixed potential and core should be earthed at two positions.

11.19 Inspection and Testing:

- The Contractor shall at its own expense carry out at the place of manufacture and/or on the Site all such tests and/or inspections of the Plant and any part of the Facilities as are specified in the Contract.
- The Employer and the Project Manager or their designated representatives shall be entitled to attend the aforesaid test and/or inspection, provided that the Employer shall bear all costs and expenses incurred in connection with such attendance including, but not limited to, all traveling and board and lodging expenses.
- Whenever the Contractor is ready to carry out any such test and/or inspection, the Contractor shall give a reasonable advance notice (15 days in advance) of such test and/or inspection and of the place and time thereof to the Project Manager. The Contractor shall obtain from any relevant third party or manufacturer any necessary permission or consent to enable the Employer and the Project Manager or their designated representatives to attend the test and/or inspection.
- The Contractor shall provide the Project Manager with a certified report of the results of any such test and/or inspection.

- The Contractor shall afford the Employer at the Employer's expense, access at any reasonable time to any place where the Plant are being manufactured or the Facilities are being installed, in order to inspect the progress and the manner of manufacture or installation, provided that the Project Manager shall give the Contractor a reasonable prior notice.
- Inspection & Testing as already mentioned the equipment shall be subjected to routine & other acceptance test as per provisions in the relevant standard codes.
- BPC reserves the right to send its Engineers if so, desires to witness manufacturing process and to reject either raw materials or finished products 10/20 found to be not complying with requirement of the specification and also shall have the right to select any/all equipment from the lot offered for tests.
- The manufacturer shall give at least fifteen (15) days in advance notice regarding readiness of such Inspection and testing and shall submit the sets of work test certificates of the materials/ equipment offered for Inspection and testing indicating probable date of Inspection and testing
- The supplier shall arrange all possible facilities for such Inspection and testing at any time during the course of manufacturing and shall notify the employer.
- The transformer may be stage inspected at the factory of the manufacturer. The manufacturer shall intimate in advance in writing to the Employer about the stages of manufacture & subsequent readiness of the transformers to enable him to carry out stage inspection & final inspection and testing of the finished transformers.

11.20 Test Certificates

- Seven (7) Copies of Test Certificates as mentioned above are to be furnished to Employer for acceptance before issuance of instruction for dispatch of the equipment.
- Anything not covered by this specification will be as per relevant ISS or other standard Specification.

12. Cables:

Cables of appropriate size as per the electrical drawing shall have the following characteristics:

- Shall meet IEC 60227/IS 694, IEC 60502/IS1554 standards.
- Temp. Range: –10^{o}C to +80^{o}C.
- Voltage rating 1.1kV / 12kV grade as per electrical drawing
- Excellent resistance to heat, cold, water, oil, abrasion, UV radiation
- Flexible
- Sizes of cables between array interconnections, array to string combiner box (SCB), SCBs to Inverter, etc. shall be so selected to keep the voltage drop (power loss) of the entire solar system to the minimum (2%).
- For the DC cabling, XLPE or, XLPO insulated and sheathed, UV stabilized single core multi-stranded flexible copper cables shall be used.
- For the AC cabling, PVC or, XLPE insulated and PVC sheathed single or, multi-core multi-stranded flexible copper cables shall be used; Outdoor AC cables shall have a UV-stabilized outer sheath.

- The cables (as per IS) should be insulated with a special grade PVC compound formulated for outdoor use. Outer sheath of cables shall be electron beam cross-linked XLPO type and black in colour.
- The DC cables from the SPV module array shall run through a UV stabilized PVC conduit pipe of adequate diameter.
- Cables and wires used for the interconnection of solar PV modules shall be provided with solar PV connectors (MC4/TS4) and couplers.
- All cables and conduit pipes shall be clamped to the support structures with thermo-plastic clamps at intervals not exceeding 50 cm; the minimum DC cable size shall be 4.0 sq.mm copper; the minimum AC cable size shall be 4.0 sq.mm copper. In three phase systems, the size of the neutral wire size shall be equal to the size of the phase wires.
- Cable Routing / Marking: All cable/wires are to be routed properly inside the HDPE pipe of suitable size. The cables should be suitably tagged and marked with proper manner by good quality ferule or by other means so that the cable easily identified.
- Cable Jacket should also be electron beam cross-linked XLPO, flame retardant, UV resistant and black in colour.
- All cables and connectors for use for installation of solar field must be of solar grade which can withstand harsh environment conditions including High temperatures, UV radiation, rain, humidity, dirt, salt, burial and M:\t\16-02-2017\forms for downloads and hard copy\documents\Technical specifications.doc Page 18 of 22 attack by moss and microbes for 25 years and voltages as per latest IEC standards. DC cables used from solar modules to array junction box shall be solar grade copper (Cu) with XLPO insulation and rated for 1.1kV as per relevant standards only.
- The ratings and size of cables (both AC and DC) shall be as per the electrical drawings provided. Any change in cabling sizes if desired by the contractor shall be approved after citing appropriate reasons. All cable schedules/ layout drawings shall be approved prior to installation.
- Multi Strand, Annealed high conductivity copper conductor PVC type 'A' pressure extruded insulation or XLPE insulation. Overall PVC/XLPE insulation for UV protection Armoured cable for underground laying. All cables conform to latest edition of IEC/ equivalent BIS Standards as specified below: BoS item / component Standard Description Standard Number Cables General Test and Measuring Methods, PVC/XLPE insulated cables for working Voltage up to and including 1100 V, UV resistant for outdoor installation IS /IEC 69947.
- The total voltage drop on the cable segments from the solar PV modules to the solar grid inverter shall not exceed 2.0%.
- The total voltage drop on the cable segments from the solar grid inverter to the LV panel ACDB shall not exceed 2.0%.

13. Supervisory Control and Data Acquisition (SCADA) System and Communication Network.

SCADA System

- The plants need to be fully automated and should be able to run on automatic and manual modes. There should be remote monitoring and control facilities. The network system architecture should be fail proof and the communication and

automation protocol selected should be robust and fast. Sensors and transducers need to capture every aspect of the plant and its equipment's, and corresponding display and control must be made available at the existing control room at the site for SCADA display with suitable a LED screen. Automation should work in order to achieve ease of operation of plant, maximizing the power generation and minimizing long run operation and maintenance cost. Provision must be made for transfer of monitoring and control (if necessary) to BPC data centre, Thimphu at IEC60870-5-104.

- The SCADA system hardware and associated equipment shall be located in the existing BPC office for 600kW wind power plant.
- All SCADA System equipment installed shall be compliant with IEEE 1613 requirements, including EMC (i.e., protected by surge suppression equipment that complies with IEEE C37.90.1).
- The Contractor shall provide all required software and instruction manuals for the operation and maintenance of the provided SCADA system.
- The SCADA system shall be provided with uninterruptible power supply (UPS) and allow for 8 hours of continuous operation when normal AC station power is not available from the office building.
- The SCADA system shall be supplied with a local on-site historian capable of storing, at a minimum, 30 days' worth of data.
- The SCADA system shall include local human-machine interface (HMI) capability that displays all available site data and perform control functions.
- The local SCADA system shall have provisions for remote access from the Employer. Remote access using external party servers shall not be permitted.
- The local SCADA shall have the following minimum remote control functions:
    - Adjustment of real and reactive power output of inverters, on an individual and/or aggregate basis.
    - Power inverters on and off.
    - Acknowledge and reset alarms for inverters
    - Trip and close of main Facility circuit breakers.
- The local SCADA shall have the following minimum data collection points:
    - Data points for inverters listed within section 10 of IEEE-1547-2018. In addition, the inverter alarms, faults, and warnings shall be provided.
    - Data from transformer.
    - Alarms and trip indication for any protective relay used.
    - Facility main breaker status and position.
    - Data from all metering including: phase voltages, phase currents, power factor, instantaneous power, etc.

Communication Requirements

- Communications facilities shall be furnished by the Contractor for the following purposes:
    - To facilitate remote data and control functions to the local SCADA system as described within this specification.
- Component Level Communication
    - Communication between components such as data loggers, meters, Inverters, weather station, and sensor I/O components shall comply with the component manufacture's installation instructions.
    - The cable shield shall be grounded on one end of the cable only.

- Inverters that have a proprietary communication protocol shall be ordered with conversion devices to connect them to the network.
- Sensor cabling shall be specified by the component manufacturer or provided with the sensors and shall not exceed manufacturer's recommended maximum length.

- Ethernet
  All Ethernet-based communication networks shall use category 6 or higher cables meeting the following requirements:
  - Sunlight, oil, and gas resistant. Rated for underground use or wet locations if used in that manner.

  Ports shall be standard Ethernet RJ-45.

- Fiber Optic
  - Optical fiber cable networks shall conform to IEEE 802.3 100BASE-FX or 1000BASE-SX or newer requirements.
  - Fiber optic cable shall meet the following requirements:
    - Fiber-optic cable shall be 62.5 micron multi-mode, or 50 micron multi-mode.
    - Fiber-optic cable shall be installed in inner duct with a minimum diameter of 1.25 inches or double armor (corrugated steel tape), double jacket, when direct buried
    - Single armor (corrugated steel tape), single jacket when installed in conduit.
    - Shall include 50% spare fiber for future use.
    - Splicing of fiber-optic cables shall not be allowed
- Switches
  - Switch ports shall be capable of both 100 Mbps and gigabit operation, full and half duplex. Switch ports shall be auto sensing so that the correct network bandwidth is applied to the connected equipment. Maximum network segment lengths shall conform to the IEEE 802.3 standard requirements.
  - Switches shall support remote management by the Owner, which is incorporated into the Contractor's network design.
- Wireless communication shall not be used. All devices shall be hardwired back to the local SCADA system.

14. Tools and Tackles:

- After completion of installation & commissioning of the power plant, necessary tools & tackles shall be provided for free of cost by the contractor for maintenance purpose.

15. Training

- The contractor shall provide a detailed training plan for all operation and maintenance procedures, which shall after approval by Owner, form the basis of the training program. Contractor shall impart training on site and at Bidder's existing solar farm / factory to 6 Owner engineers in O&M of solar technology and associated equipment for two weeks.

16. Danger Boards, Signage & Fire Extinguishers:

- Danger boards should be provided as and where necessary as per IE Act. /IE rules as amended up to date. A single signage shall be provided at the entrance of the plant.
- The firefighting system for the proposed power plant for fire protection shall be consisting of:
    - Portable fire extinguishers for fire caused by electrical short circuits.
    - Sand buckets.
    - The installation of Fire Extinguishers should confirm to TAC regulations and BIS standards.

Section 2C – Installation, Testing and Commissioning

INSTALLATION

1.0 GENERAL

1.1 The scope shall cover complete installation of plant items and accessories as indicated in various parts of the specification. Requirements/ guidelines/ information/ parameters/ instructions etc. specified in this part shall apply to all the parts.

1.2 Installation work pertaining to plant items shall comply with the applicable standards, safety codes etc.

1.3 Installation shall be carried out strictly in accordance with the approved drawings. Changes, modifications, if any, required to suit site conditions, shall be carried out only with the prior approval of the Engineer/Employer. All such changes shall be incorporated in the "As built" drawings as provided by the Employer.

1.4 All tools, welding equipment, crane, scaffolding, rigging materials, ladders, consumables, hardware etc. required for installation shall be provided by the Contractor.

1.5 It shall be the responsibility of the Contractor to engage specialist engineers from his Sub-contractors/Manufacturers to supervise installation work for the entire power plant. Such services shall be arranged by the Contractor at no extra cost to the Employer.

1.6 It shall be the responsibility of the Contractor to obtain approval/clearance, if any, from local statutory authorities, for conducting any work for completed installation.

1.7 The Contractor shall ensure that all equipments under erection as well as the work area and the project site are kept clean as per the ISO standards and satisfaction of the Engineer/Employer. In case the Engineer/Employer is not satisfied about the site cleanliness, he will have the right to carry out the cleaning operations and expenditure incurred in this regard will be to Contractor's account, which will be deducted from the bills. Packing cases and packing material, except for spares shall be cleared from sites.

1.8 In order to avoid hazards to personnel moving around the plant which is kept charged after installation before commissioning, the plant shall fenced properly as shown in the civil drawings.

1.9 The plant machinery, switchgear and control/relay panels shall be installed as per the drawings provided. Proper aligning, installing panels, combiner box, inverters, 415V and 11kV outdoor panels, transformer, inter panel wiring, transformer connection, grid connection, etc. will be the responsibility of Contractor.

1.10 The Contractor shall take utmost care in handling all equipments. Wherever the instruments and relays are supplied separately, they shall be installed only after erection of switchgear/ relay panels is complete.

2.0 CABLING SYSTEM

2.1 All apparatus, connections and cable work shall be designed and arranged to minimise risk of fire and any damage, which might be caused in the event of a fire.

2.2 The 11kV cable from Transformer to the grid connection point shall be laid directly buried in earth. All other 1.1 kV grade DC and AC cables shall be laid in HDPE pipes as specified in the electrical drawings.
The Contractor's scope of work includes unloading, excavation, laying, backfilling, fixing, bending and terminating the cables. The Contractor shall supply the necessary material and accessories required for installation and termination of the cables which shall include but not be limited to items such as glands, lugs, terminating accessories, hardware, consumables, saddles/spacers, GI conduits/pipes, cable identification tags, protective bricks, civil materials, etc.

2.3 Buried Cables

2.3.1 Cable installation in outdoor areas such as switchgear to 11kV structure shall be directly buried. Stabilized thermal backfilling shall be used for directly buried cables. Cabling from junction box, SCBs, inverters and 415V panel shall be carried out in HDPE conduit/pipes. 11 kV cables shall be buried at a depth of minimum 900 mm. For road crossings, the pipe for the cables shall be buried at not less than one metre depth.

2.3.2 All cables to be routed along any particular route shall be laid at one time to avoid repeated excavation, etc. Cable route markers shall be provided for directly buried cables at an interval of 30 m and at every bend on the route in the buried cable trench.

2.3.3 Where groups of MV and LV and control cables are to be laid along the same route, suitable metallic barriers to segregate them physically shall be employed. When power cables are laid in the proximity of communication cables, minimum horizontal and vertical separation of 300 mm shall be maintained. Power and communication cables shall, as far as possible, cross at right angles to each other.

2.4 Cable Pulling

Standard cable grips and reels shall be utilised for cable pulling. If unduly difficult pulling occurs, the Contractor shall check the pull required and suspend pulling until further procedure has been approved by the Engineer's Representative. The maximum pull tension shall not exceed the recommended value for the cable measured by the tension dynamometer. In general, any lubricant that does not injure the overall covering and does not set up undesirable conditions of electrostatic stress or electrostatic charge may be used to assist in the pulling of insulated cables in conduit / pipes and ducts.

2.5 Each cable shall be pulled into the particular conduit/pipe. Care shall be taken to avoid sharp bending or kinking cables, damaging insulation or stressing cable beyond manufacturer's recommendations in pulling. Cable shall be protected at all times from mechanical injury and from absorption of moisture at unprotected ends. The bending radius for various types of cables shall not be less than 15 times the overall diameter of the cable for armoured cables and 20 times the overall diameter of the cable for unarmoured cables.

2.6 Cables on cable racks and in conduits/pipes shall be formed to avoid bearing against edges of trays, racks, conduit / pipes or their supports upon entering or leaving racks or conduit/pipes.

2.7 Cables splices shall not be used except where permitted by the Engineer's Representative. Splices shall be made by Contractor for each type of wire or cable in accordance with the instructions issued by cable manufacturers and the Engineer's Representative. Before splicing, insulated cables shall have conductor insulation stepped and bound or penciled for recommended distance back from splices to provide a long leakage path. After splicing, insulation equal to that on the spliced conductors shall be applied at each splice.

2.8 At cable terminal points, where the conductor and cable insulation will be terminated, terminations shall be made in a neat, skillful and approved manner by specially trained staff. Terminations shall be made by the Contractor for each type of wire or cable in accordance with instructions issued by cable manufacturers and / or the Engineer's Representative.

2.9 Control cable termination shall be made in accordance with wiring diagrams, using proper colour codes for the various control circuit.

2.10 When control cables are to be fanned out and corded together with a cord, the Contractor shall make connections to terminal blocks, and test the equipment for proper operation before cables are corded together. If there is any doubt about correctness of connection, the Contractor shall make a temporary connection with sufficient length of cable so that the cable can be switched to another terminal without splicing. After correct connections are established, cables shall be cut to their correct lengths, connected to terminals in the specified manner, and corded together where necessary to hold them in place in a skillful manner. Jointing of cables shall be in accordance with relevant Standards and manufacturer's instructions. Materials and tools required for cable jointing work shall be supplied by the Contractor. Cables shall be firmly clamped on either side of a ‘straight through joint’ at a distance of not more than 300 mm away from the joints. Identification tags shall be provided at each joint at all cable terminations.

2.11 Cable seals shall be examined to ascertain if they are intact and that cable ends are not damaged. If the seals are found to be broken, the cable ends shall not be jointed until after due examination and testing under supervision of the Engineer's Representative. Before jointing is commenced, insulation resistance of both sections of cables to be jointed shall be checked by megger.

2.12 In each cable run, some extra length shall be kept at a suitable point to enable one or two straight-through joints to be made, should the cable develop fault at a later date.

2.13 Conduits / Pipes

2.13.1 The DC and AC 1.1kV grade cables as specified in the electrical drawings shall be laid in HDPE conduits/ pipes routed neatly along the panel mounting structure or buried in ground as and where required.
Supply and installation of HDPE pipes and their accessories required for installation shall be included in the Contractor's scope.

2.13.2 The conduits and pipes shall be properly sealed by the sealing compound.

3.0 TESTING AND COMMISSIONING

SCOPE

3.1 The Contractor shall carry out commissioning tests/completion checks in the presence of an engineer appointed by the Employer/Engineer. The commissioning engineer may verify any commissioning tests/completion checks to satisfy himself that the plant is fit and sound. The evaluation of test results and decision passed by the commissioning engineer regarding the test results will be final and binding on the Contractor. Any additional tests or repetition of tests to establish satisfactory operation of any equipment shall be carried out by the Contractor if so desired by the commissioning engineer at no extra cost. The test report needs to be signed by the engineer appointed by the employer, which shall be submitted during handing/taking over.

3.2 The commissioning tests/completion checks to be carried out shall include, but not be limited to, those described in subsequent paragraphs, as applicable to the individual equipment / system.

4.0 COMPLETION CHECKS/ COMMISSIONING TESTS

4.1 Preliminary Checks

a) Name plate details according to approved drawings / specifications
b) Any physical damage or defect and cleanliness
c) Tightness of all bolts, clamps and connections
d) Leakages
e) Condition of accessories and their completeness
f) Clearances
g) Earthing connections
h) Correctness of installation with respect to approved drawings / specifications
i) Alignment
j) Correctness and condition of connections

4.2 General tests

In general, the following tests shall be carried out on all the equipment / systems, as applicable.

a) Insulation resistance measurement
b) Dielectric tests
c) Phase sequence and polarity
d) Voltage and current ratios
e) Vector group
f) Resistance measurement of winding, contacts, etc.
g) Continuity tests
h) Calibration of indicators, meters, relays, etc.
i) Control and interlock checks
j) Settings of equipment and accessories
k) Checking of accuracy / error
l) Checking of operating characteristics, pick-up voltages and currents, etc.
m) Operational and functional tests on equipment, accessories, control schemes, alarm / trip / indication circuits, etc.
n) Measurement of guaranteed / approved design values including lighting levels, earth resistance measurement, etc.
o) Complete system commissioning checks
p) Vibration checks
q) Balancing checks

4.3 Among other commissioning tests, the contractor shall test all the equipments such as per relevant standard at site after completion of installation. Contractor shall ensure use of calibrated test equipment having valid calibration test certificates from standard laboratories traceable to National Standards / International Standards. All tests shall be carried out in the presence of Engineer's representatives.

5.0 TAKING OVER

5.1 No item of the entire Works will be certified for 'Taking over' unless it has passed all the tests.

5.2 A 'Taking Over' Certificate for Works will be issued only after the requisite documentation of commissioning tests are duly compiled and approved by the Employer / Engineer.

Section 2D – Drawings, Test Certificates, O&M manuals

SCHEDULE 2D - DRAWINGS, TEST CERTIFICATES AND OPERATING AND MAINTENANCE MANUALS

1.0 DRAWINGS

1.1 The Design and Engineering for both Civil and Electrical Component of the project is complete in all respect by Renewable Energy Division (RED) under Distribution Construction Department, BPC and approved by Engineering and Research Department, BPC.

1.2 The list of the attached drawings includes:

1.2.1 Civil Drawings:

1.2.1.1 Site Plan
1.2.1.2 Layout Plan
1.2.1.3 Sectional detail of slope
1.2.1.4 Front view with panels
1.2.1.5 Section x-x of mounting structure-1
1.2.1.6 Section x-x of mounting structure-2
1.2.1.7 Section y-y
1.2.1.8 Mounting structure joint details
1.2.1.9 Details of footings
1.2.1.10 Details of GI chain-link fence-1
1.2.1.11 Detail of GI chain-link fence-2
1.2.1.12 Sectional elevation of gate for fencing
1.2.1.13 Foundations for LV and 11kV Outdoor Panels

1.2.2 Electrical Drawings:

1.2.2.1 Legends
1.2.2.2 String Wiring Layout Plan
1.2.2.3 String Combiner Boxes (SCBs) and Inverter Layout Plan
1.2.2.4 Layout of 415V and 11kV Panels
1.2.2.5 Earthing and Lightning Arrestor Layout Plan
1.2.2.6 Single Line Diagram

2.0 TEST CERTIFICATES

2.1 Type Test Certificates

2.1.1 Type test certificates for all the plant items and accessories shall be furnished.

2.1.2 Type test certificates shall be furnished for tests carried out on similar type/design of equipment.

2.1.3 Type test certificates will be accepted, if date of the certificate is not earlier than 5 years as on date of Bid submission and in the event there is any deviation to the tested equipment from the offered equipment or the certificate is earlier then the stipulated period, the Employer reserves to get the type testing done without any extra cost.

2.2 **Routine Test Certificates**

2.2.1 Routine test certificates for all the plant items and accessories shall be furnished.

2.2.2 Routine test certificates shall be furnished in addition to test reports, which will be collected at the time of inspection.

2.2.3 Routine test certificates shall be furnished for review by the Engineer within seven (7) days after completion of inspection of relevant item or as instructed by the Engineer in case of items for which witnessing of tests is waived.

3.0 OTHER DOCUMENTS

3.1 Technical catalogues, descriptive literature, characteristic curves, write-up on schemes where required in support of relevant control/annunciation drawings etc. shall be furnished for all the items of plant and accessories/components.

4.0 OPERATING AND MAINTENANCE MANUALS

4.1 The Contractor shall provide five (5) bound sets of approved manuals. All descriptive leaflets, instruction sheets, charts, lists, pamphlets and other documents that are used in compiling each manual shall be contained in one or more binders designed to prevent loss of contents. Each binding shall be titled with the name of the Employer, the name of the project, the Contract number, the name of the Contractor and with information to identify the subject matter and shall include a detailed index to all the literature contained therein.

4.2 The manuals shall be initially approved in draft form by the Engineer and shall cover all items of the Works. For this purpose, three (3) draft copies shall be submitted to the Engineer. Final submission of manuals shall be done after satisfactory completion of commissioning tests. A mere collection of manufacturers' descriptive leaflets will not be acceptable in satisfaction of this Clause. Information pertaining to items selected for this project shall be clearly indicated in such leaflets. The manuals shall comprise both operating instructions and maintenance instructions.

4.3 A separate section of a manual shall be devoted to each size and type of equipment. It shall contain a detailed description of its construction and operation and shall include all relevant pamphlets and a list of parts with procedure for ordering spares. Operation of electrical equipment shall be described step by step giving the complete sequence of operation. The detailed sections of the manual, if necessary, shall contain further maintenance instructions and fault location charts.

4.4 The manuals shall be printed on A4 size sheets and shall be bound. Reduced copies of record drawings shall also be included in the manuals.

4.5 The operating instructions shall include the following:

4.5.1 Step by step directions on setting the plant to work, listing all adjustments and settings necessary for the correct functioning of the plant.

4.5.2 List of plant alarms giving possible causes for alarm initiation and sequence of remedial actions to be taken.

4.5.3 Instructions on monitoring of plant performance and sample log sheets for each plant item, to be filled by operators on a routine basis.

4.5.4 "Do's" and "Don'ts" in plant operations. Operators' attention shall be drawn to all operations considered to be dangerous to operators or likely to cause damage to the plant.

4.6 The maintenance instructions shall include the following:

4.6.1 Checking, testing and replacement procedures to be carried out on all plant items on a daily, weekly and monthly basis or at longer intervals to ensure trouble-free operation.

4.6.2 Fault locations and remedy charts to facilitate tracing the cause of malfunctions or breakdown and correcting faults.

4.6.3 A complete list of manufacturer's instructions for operation and maintenance of all bought-out equipment. The list shall be tabulated in alphabetical order giving the name of supplier/manufacturer, identification of the plant item giving the model number and the literature provided including instruction leaflets and drawing numbers.

4.6.4 Full instructions to cover the complete dismantling and re-assembly of all items of plant.

4.6.5 Part-list and drawings or exploded diagrams for such items of plant showing manufacturing tolerances, matching clearances between machined components at the time of supply, maximum wear and clearances permitted to facilitate replacement.

Section 2E – Contractor Safety Program

SECTION 2E - CONTRACTORS SAFETY PROGRAMME

1.0 SAFETY ORGANISATION

1.1 Safety Policy

The Contract Organisation shall have a written health and safety policy issued by the Chief Executive of the Organisation; appropriate to the scale and nature of the risks involved in the contract works. A copy of the Policy shall be made available to the Employer at the time of contract in evidence of Contractor's commitment to management of employee's health and safety and compliance to Statutory and regulatory requirements. The Policy along with its Component operation procedures shall be evidenced as working document publicised among Contractor's and his Sub-contractors' employees through appropriate language/s. All Contractors' employees shall be familiar with the Safety Policy and their role and obligations in its implementation. The Policy shall meet the relevant statutory and regulatory requirements and the requirements of the Employer. The Policy shall periodically be reviewed for updating with respect to new and emerging legal and other requirements.

The contractor shall also refer to BPC safety guidelines and instructions which will be given to a successful bidder.

1.2 Safety Representative

a) Contractor shall appoint a Safety Representative (SR) meeting statutory competence requirements, with a minimum experience of five years of safety management in comparable contracts, approved by the Employer on the basis of his qualification and experience. The SR shall give his whole time to the superintendence of the Health and Safety Programme of the Contractor.

b) The Contractor shall also nominate in writing competent Safety Appointees from different disciplines to assist SR in implementation of health and safety measures in their routine contract works. The SR shall have sufficient authority to direct Contractor's or his Subcontractor's personnel to meet health and safety requirements and to stop performance of work until such requirements are met.

1.3 Employee Consultations, Safety Committee and Communication

a) Contractor shall ensure full involvement of all his employees recognising their right to consultation on health and safety matters. The safety appointees of the various areas, in conjunction with the SR shall be responsible for ensuring employees' involvement through routine safety inspections, hazard and risk assessment in new and changed works and their control. Contractor shall maintain appropriate operating procedures to guide these requirements.

b) The Contractor shall also appoint a Safety Committee (SC) comprising of Safety Appointees from the various areas under the chairmanship of the SR. The committee shall meet at periodic intervals to discuss the status and adequacy of the safety management, and any safety concerns of the employees. The committee shall also formulate and validate the safety procedures incorporating controls to prevent or mitigate hazards and risks before

submission for approval by Employer / Engineer. The minutes of SC meeting shall be submitted to the Employer / Engineer. SR shall maintain the records of the meetings.

c) Contractor shall communicate to the employees regularly on job hazards applicable to their tasks in hand. Safety Appointees (SA's or any of SR's nominees) shall hold 'Toolbox talks' for this purpose on a routine basis before undertaking any safety critical and / or non-routine activities. Weekly meetings of the Contractor and his Subcontractor attended by the SR and SA's shall include safety as a key item in the agenda to discuss hazards and risk assessments, Job safety analysis, control procedures and to review accidents and incidents (Near-miss) for remedial measures to prevent such occurrence. The minutes of the meeting shall be submitted to the Employer / Contractor. SR shall maintain the records.

1.4 Contractor's safety reports

The Contractor shall submit a monthly written report to the Employer / Engineer, which shall be due on the fifth workday of every month. The health and safety of all full time, part-time, permanent, temporary contract employees and any outsourced employee undertaking any part of the contract-works shall be included in the safety report. The report shall include the total number of working hours for the month, the number of recordable accidents and the number of lost-time accidents. A cumulative trend plot of the monthly severity and frequency rate of the reportable accidents shall be included in the monthly safety report and calculated as:

$$\textbf{SEVERITY} = \frac{\text{LOST MANDAYS DUE TO LOSS-TIME INJURIES}}{\text{MANHOURS WORKED}} \times 1000000$$

$$\textbf{FREQUENCY} = \frac{\text{NUMBER OF LOST TIME INJURY}}{\text{MANHOURS WORKED}} \times 1000000$$

Contractor shall arrange to display the safety statistics and the cumulative plot of severity and frequency of accidents mentioned above painted in a board prominently displayed, as a means of encouragement and assurance to all interested parties and for publicising the safety achievements.

1.5 Contractor's accident/incident reports

"Accident" for the purpose of this clause is defined as "Undesired event giving rise to death, ill-health, injury, damage or other loss" and "Incident" is defined as “Event that gave rise to an accident or had the potential to lead to an accident”. An accident where no ill health, injury, damage or other loss occurs also referred to as "near-miss". Incident includes near miss.

The Contractor shall report orally, to Employer and Engineer regardless of their extent, duration and severity, immediately on occurrence of all accidents resulting in:

a) personal injury,
b) property damages,
c) Fires,

d) spills and
e) Near misses.

Contractor shall submit the accident / incident report in writing to Employer / Engineer within 24 hours of its happening in the form as prescribed by the governing statute or in the absence of which, in the form prescribed by the Engineer. Contractor shall detail in the Accident / Incident report, the particulars of the dangerous occurrence leading to the accident, lost time of absence due to accident, root cause analysis and the corrective and preventive actions to prevent such recurrence. In addition, Contractor shall include his estimate of the impact of accident on project schedule. Incidents shall also be reported in the same manner identifying root cause(s) to eliminate such potential occurrence or risks.

1.6 First - aid personnel and facilities

a) The contractor shall make available first-aides, first-aid boxes and / or first aid stations as per statutory requirements. The persons holding current certificates of competency of recognised institutions in prescribed numbers as per any governing statute and in the absence of such regulatory requirement a minimum of two first-aides for each area of work for every hundred workmen shall be available. First-aides' names shall be prominently displayed.

b) The first -aid boxes shall display contents of medical and medicinal articles with quantity maintained, which shall be in accordance with governing statute. Nominated first-aider shall replenish stock promptly.

c) The first-aid refresher training shall be provided at least once in a year and all employees shall be encouraged to undergo first-aid training. A record shall be kept of all first aid treatments with particulars of treatment and personnel providing the treatment.

1.7 Ambulance room and Ambulance Vans

Employer shall arrange for an ambulance room and an ambulance van directly or outsource the facilities meeting the governing statutory needs for prompt transportation of serious cases of accident and or sickness to the Hospital. Such facilities such as dry powder type extinguishers, flashlights, portable Oxygen Unit, self-contained breathing apparatus, etc. as prescribed by the governing statue.

1.8 Induction and job-safety training

a) Contractor shall maintain a procedure for identification of the training needs and training his employees to create a health and safety conscious work force that will comply with the law and safety requirements of the Organisation. He shall also maintain a procedure for safety induction and initial training as well as follow-up training on the job safety for new entrants. All employees shall receive effective training and periodic refresher training on the operation control procedures specific to their tasks designed to control the job-safety risks. A booklet of such operation control procedures and safety rules with need based pictorial illustrations shall be made available to all employees who

are to learn and be familiar with such procedures. All training shall be monitored for effectiveness as per established procedures. Contractor shall maintain records of all training.

b) Safety Representative and Safety Appointees shall conduct regular fortnightly or weekly mock-safety drills for different imaginary accident scenarios, in premeditated work so as to provide on-job training such as:

i use of safety appliances such as water monitors, hydrants, hydrant pumps, fire-hoses, extinguishers, breathing apparatus and safety harness for working at height,
ii response to health & safety emergencies,
iii fighting fires using different equipment and
iv first aid

Participants shall receive training during mock-drills through role-play of their normal expected tasks during emergencies and fire fighting. The degree of demonstrated ability in the chosen tasks during such safety drills shall be recorded as participants' competence level for planning his further training. The experience gained in mockdrills shall be used to update of operational control procedures and the training needs. The roster of participants and contents for routine mock-drills shall be appropriately planned to cover all employees in the training at least once in four months.

c) The Safety Representative and Safety Appointees shall be trained on a standardised comprehensive advanced training programme covering safety management, legal aspects, techniques of hazard identification and risk assessment and specific job-safety in various disciplines of the plant and equipment of the Contractor. The training records shall be maintained subject to audit by Employer / Engineer. Training effectiveness shall be assessed and recorded and used as input for further training plans of the employee.

1.9 Health and Safety Promotion

Safety posters, banners and slogans displayed for safety promotion shall be rotated at frequent intervals. The Contractor is encouraged to have safety promotion as an item in the safety committee agenda. Contractor is encouraged to include safety promotion programmes such as safety bulletins, magazines, competitions in slogan and poetry writing on safety, screening of safety films, celebration of national safety and environmental day, safety suggestion schemes and safety library, etc.

1.10 Purchase and Procurement Control

a) The Contractor shall maintain a procedure for control of his purchases to ensure that all safety requirements are appropriately vetted by the safety personnel during all stages of procurement including planning of specifications, inspection for acceptance and commissioning in order that threats to safety are not overlooked and appropriate attention is paid to the training of personnel in the operation of Contractor's new or changed machinery and their operation control procedures, to prevent / control risks.

b) Contractor shall exercise due diligence in appointing his Sub-contractors and outsourcing contract services that no new health and safety threats are created.

Contractor shall ensure personnel of Sub-contractors and outsourced contract services are competent in health and safety management to meet the Policy requirements. They shall be made aware of the safety rules, emergency procedures and any information that will have a bearing on the safety, health and related contractual obligations

1.11 Hazard Identification and Risk Assessment

a) Contractor shall ensure that his key personnel and safety personnel are trained to be competent in hazard identification, risk assessment and risk control processes. Contractor shall on a routine basis identify, evaluate and control all health and safety risks especially in the hazardous work activities and also to validate the previous risk assessments. Elements such as hazard identification, evaluation of risks with existing control measures in place and estimate of tolerability of the residual risks shall be an ongoing process. Any additional / new control measures shall be designed based on this process on need basis.

b) Contractor shall maintain a Hazard Identification, Risk Analysis and Risk Control Manual (HIRARC) pertaining to all his activities duly updated as detailed above. The HIRARC manual shall be made available to the Engineer during regular inspections and audits.

1.12 Work Permits

The Contractor shall maintain a work permit procedure to limit the hazardous processes and high risks tasks to authorised personnel, who shall be informed of the job safety analysis and the job specific safety precautions, on issue of a work-permit. The work permit issued under the procedure shall be valid for a specified period and shall be issued only after all safety precautions are fulfilled and duly verified by SR / SA or specialists who are authorised for safety certification as a prerequisite for issue of a work permit. The work permit shall be appropriate for the purpose for which it is issued. The different work-permits are:

a) Safety Work Permit (SWP)

SWP is mandatory for working in heights, on fragile roofs such as Asbestos or such roofing works, Steel Erection, Work over water, a live substation or switchyard even if section of work is not electrically charged, Demolition, Blasting and such potentially hazardous Contract works in the opinion of the Employer / Engineer.

b) Electrical Safety permits/Lock-out and tag out (ESP: LOTO)

Contractor shall institute an electrical safety permit system to ensure safe electrical isolation. Safety permits shall not be issued until safe release tag is placed on the equipment isolated on all isolating points. The safety permit shall be returned on satisfactory completion of the job by the executing agencies duly signing off indicating that all shorts and grounds and men and materials are removed from the job and that the job is safe for energising. This is a prerequisite to energise the isolated equipment. The safety tags shall be collected in the order i.e. first the isolated equipment and lastly the tag on the main control of the equipment. The tags and permit system shall be auditable.

1.13 Job Safety Inspection

The contractor shall maintain a procedure for Safety Inspection at routine intervals to provide assurance that the instituted safety procedures are in place to prevent deviations from established standards that could lead to a safety hazard and consequential risk. The Contractor shall establish appropriate standardised checklists for systematic job safety verification to ensure:

a) set standards are followed without deviation,
b) employees are competent to perform as per prescribed operation control procedures,
c) monitoring of safety of the various work areas/tasks and
d) adequacy of existing operation control procedures and practices to mitigate and eliminate risks.

Should the existing operation control procedures prove inadequate and the residual risks are higher than tolerable levels, SR shall initiate hazard and risk assessment / analysis and consultations with Safety Committee to deploy appropriate remedial measures and improved operation control procedures. Periodic inspection reports and proposed remedial measures shall be submitted to the Employer. Records of changes in processes; consultations with Safety Committee and revision of Operational controls shall all constitute objective evidence of the existence of established procedures.

1.14 Safety Audits

a) Contractor shall undertake periodic safety audits to confirm through investigative methods the effectiveness of the measures set out in the Safety Policy. In order to be effective such safety audit shall be comprehensively covering all aspects detailed in this specification to ensure effective Loss-control / accident prevention programme. Safety audits shall take into account the safety inspection records, remedial measures and effectiveness of the safety programme. Effectiveness of Safety Programme shall be based on Contractor's effective Hazard identification and risk assessment processes for design of Operation control procedures and on the safety statistics. Audit reports and preventive actions and Safety Improvement programmes shall be submitted to Employer.

b) Employer shall retain his right to audit Contractor's Safety Management System either directly by his Employees or his nominated representatives for its effectiveness.

2.0 EQUIPMENT AND SUBSTANCES AND PERSONAL SAFE-GUARDING

2.1 Mechanical Safety

a) Contractor shall ensure that all his equipment and machinery are safe to use while in motion or working. Operators shall have received training or instruction on operation of the machinery and the regulatory requirements. Contractor shall have adequate procedure to ensure the stability and securing of his working machinery during operation. He shall restrict repair and

maintenance of the machinery to trained personnel and maintain records of repairs and maintenance. The equipment shall have appropriately designed means of isolating from sources of energy and shall have emergency stop control, which is easily accessible. All controls shall be clearly and uniformly marked. All operation controls, interlocks, sensing devices and guards on tools and equipment shall be functional and their status shall be regularly checked and recorded. Contractor shall provide evidence of compliance to these requirements in any contractual write-ups submitted to Employer / Engineer for approval in respect of critical construction / contract works.

b) Contractor shall provide only good quality handtools and ensure control of condition, storage, routine inspection and use of such hand-tools. Unsafe tools such as with cracked or broken handles, mushroomed chisels and punches, worn screwdrivers, hardened hammerheads; power tools with unsafe resistance to earth or without safety guards shall be prohibited.

c) All safety ladders, scaffolding and access equipment shall meet requirements of IS 3696 and IS 4014:1967 and any such standards that the Employer / Engineer may stipulate. The safety work permits shall be issued only after ensuring that all safety requirements of access equipment are complied with. Access equipment shall be inspected on a routine basis to prevent injuries caused by falls.

d) Contractor shall ensure safety of all those concerned with lifting and those who may be affected by material hoisting, lifting and handling using various mechanical aids. All lifting equipment such as cranes, hoists, lifting shackles, hooks chains and links shall be designed as per appropriate International codes of construction. Operators shall have been trained in operation and maintenance of such equipment besides training on standard hand signals to be employed during the hoisting and lifting operations. Safe working loads (SWL) shall be marked on equipment prominently. SWL shall be evidenced to have been established by test procedures in accordance with acceptable codes of practices.

e) Riding on construction equipment, forklifts and cranes shall be prohibited unless such vehicles are provided with passenger seats.

f) Signs, barricades, barrier tapes and warning or entry restriction devices or accessories shall be provided to minimise work related risks of accidents and injuries. Signage shall meet all regulatory requirements such as The Building and other Construction Workers Act 1996, Factory Act 1948, Manufacture, Storage, Import of Hazardous Chemicals Rules under Environmental Protection Act 1986, Indian Explosives Act 1984 and Gas Cylinder Rules 1981 and Indian Electricity Act 1910 and Rules there of and any other safety requirements of Employer / Engineer, as applicable.

2.2 Electrical equipment - Safety

a) Contractor shall provide only such equipment for work that is electrically safe to work. Contractor shall have a procedure to identify and record all his electrical equipment in a register, with provisions to record his periodic inspections of such equipment. Inspection shall cover cables, extension leads, all electrical equipment drawing power from socket outlet. He shall identify

and maintain in good working order all electrical installations such as distribution panels and major switchgear ensuring safe accessibility. A clear area shall be maintained around Panels and switchgear. The installed equipment shall be periodically inspected by qualified personnel to ensure their continued safe operating condition. Inspection shall include earth polarity checks, continuity checks and earth resistance checks. Contractor shall ensure use of flameproof and explosion proof switchgear and lighting fittings where required as per governing codes.

b) Approved earth leakage relays or alternative safety devices to relevant IS/International codes shall be used on all portable electrical hand tools. Where possible low-voltage electric power supply shall be used for handtools. Earth leakage units shall protect electrical installations in storeroom, pantry, transit rest room, Office / Record room, switchgear rooms, control room and battery room. Record of regular checks shall be maintained. Contractor shall comply with "Code of practice for earthing" as per IS 3043:1987.

c) Safety rubber matting of appropriate voltage rating conforming to IS 5424:1969 titled "Rubber mats for electrical purposes" shall be provided in front of all switchgear and power distribution panels for the safety of personnel operating such equipment.

d) Contractor shall arrange displaying signages under Indian Electricity Act 1910, such as :

i Danger notices as per IS 2551 in conspicuous places on all low, medium and high voltage installations as per Rule 35,
ii Instruction of restoration of persons suffering from electric shock in English and local languages as per Rule 44 in switchgear rooms, substations and places where electricity is used and
iii Notice prohibiting unauthorised entry in areas where electrical apparatus are used.

e) All power cables providing construction power to various constructions machinery and the connectors shall be in safe and sound condition. Cables shall be routed through cable trays supported on appropriately designed structures, duly clamped, secured and identified. Road crossing cables shall be laid in conduits buried at least 600 mm below the surface to prevent damage due to vehicular traffic. All cables shall be off the floor to avoid damage or tripping hazard. Cables shall be terminated at the switchgear and sockets in a workman-like manner to prevent loose contacts and flashover. Only safety receptacles shall be used for providing power connection to hand-tools. All switches and distribution boards shall be clearly marked. All electrical distribution and panel wiring diagrams shall be available with the electrical maintenance personnel. Contractor shall maintain a safe electrical isolation / lockout procedure.

f) Contractor shall ensure lighting circuits are not used for hand-tools. No electrical equipment shall be overloaded. Tools and test equipment used on electrical systems shall be insulated.

2.3 Substances abuse plan

The contractor is encouraged to have a "substance abuse programme", and pre-employment drug testing. Drinking during working hours shall be strictly prohibited. Contractor shall promote through poster and other publicity, awareness on abuse of substances such as alcohol and such depressant drugs that slows the activity of brain and spinal cord on abusive usage endangering the safety and health of users and others affected by their work.

2.4 Hazardous substances control

a) Contractor shall prevent all injuries, illnesses and damage to property or the environment caused by any article or substance, which proves to be hazardous. The code of practices of construction, operation, maintenance and control procedures shall meet required statutory and regulatory requirements. Personnel shall be trained on use, handling, storage and disposal of emergency spillage procedures.

b) Contractor shall detail and deploy Operational controls to reduce hazardous wastes and their disposal as required by the statute "Hazardous Waste (Management and handling) Rules 2000". Oil wastes, used oils, soil and cotton soaked in oil consequent to handling operations, grease, many class of paints, asbestos sheets and gaskets are typical hazardous wastes.

3.0 PERSONAL SAFGUARDING

3.1 Personal protection equipment (PPE): general

Contractor shall provide his employees required PPE meeting the requirements of the stated IS Specifications and Guidelines or equivalent International Standards as may be prescribed by the Engineer from time to time. Contractor shall have instituted good working procedures and practices in providing PPE, maintenance, issue and training on their use. All PPE shall be periodically checked to ensure worn so that damaged equipment are replaced expeditiously.

a) Control of use of issue, use and maintenance of PPE:

Employees shall be responsible for PPE issued to them. Contractor shall meet requirements of IS 8519: 1977 titled "Guide for selection of Industrial safety equipment for body protection" or any equivalent International Specification that the Employer / Engineer may prescribe.

b) Head Protection:

Contractor shall comply with requirements as per IS 2925. It is mandatory for the contractor to provide safety helmets to all the persons working at the site.

c) Eye and face protection:

Eye protection shall be worn during all operations by operators and people in the vicinity, where there is a danger of flying particles of metal such as generated during use of hand tools such as chisels, grinding, welding and

cutting lathe work on brass and cast iron acid and alkali splash, and high pressure jet cleaning or insulation removal from heights using high pressure jets. Contractor shall meet the requirements of IS 8540:1978 titled "Guide for selection of Industrial safety equipment for eye and face protection".

d) Footwear:

Safety shoes boots and gumboots fitted with steel toecaps of approved quality conforming to prescribed Indian or International standards shall be used. Wearing of unsafe safety shoes such as jogging shoes, tennis shoes, slippers and sandal etc. shall be prohibited. Contractor shall meet the requirements of IS 10667:1983 titled "Guide for selection of Industrial safety equipment for protection of foot and leg."

e) Protective clothing:

Contractor shall prevent hazards of loose clothes worn by workmen getting caught in moving machine parts. Loose and thin garments such as Dhoti and pyjamas shall be prohibited. While Contractors shall ensure that all workmen wear long sleeved shirts, jackets or the like with the sleeves rolled down and secured at the cuff, long pants / trousers extending upto the top of the safety shoes so as to prevent injuries caused by contact with heat, cold abrasive and sharp surfaces shall be strictly enforced. Contractor shall meet the requirements of IS 8990:1978 titled "maintenance and care of industrial safety clothing."

f) Hand Protection:

Contractor shall provide appropriate hand gloves as per IS 8807:1978 titled: "Safety equipment for protection of arms and hands" to prevent injuries to hands during work. Contractor shall maintain appropriate inventory of gloves for different applications like acid / alkali handling, general-purpose work gloves and asbestos or heat resistant hand gloves, etc.

g) Safety harness: Fall arrest:

Contractor shall provide safety harness or means of restraint such as safety belts, harness and lifelines, etc to workmen engaged to work in heights such as Open – sided Floors, Open-sided scaffoldings, floor and roof openings, overhead construction works of various nature, etc where there is a falling hazard of six feet or above. Storage, issue wearing and maintenance of safety harness shall be under strict supervision and records shall be maintained. All fall arrests shall consist of full-body harnesses, lanyards with shock absorbers, lifelines, rope grabs and associated hardware. Two alternate lanyards shall be used to facilitate tying off at a new location before disconnecting from the previous locations of practices for safety harnesses and fall arrests shall conform to IS 4912:1978, IS 11972:1987, IS 8519:1977 or equivalent International codes.

h) Falling object protection:

Where work is in progress in elevated areas; barricades, barrier tapes signs and such entry restriction devices shall be used to keep area below clear of personnel to prevent injury due to falling objects. If work is required in the area

below elevated work area, it shall be scheduled at a time different from elevated works. The workmen below shall be protected from falling objects by the debris net or a catch platform with an adequate toe board to prevent material from falling off. Use of safety net for elevated works shall be considered in the work-permits where appropriate. Where a lift is made above a working area, the area below the path of the lift shall be cleared of personnel during the lift and barricaded and guarded to prevent entry of persons generally in conformity with IS 4912, IS 11972 and IS 13416 for "protective barriers in and around building and preventive measures against safety hazards in work places and safety requirements for floor and wall opening, railings and toe-boards".

i) Hearing conservation:

Contractor shall ensure reasonable precautions are taken to avoid injury to the hearing of the employee. All noise levels shall be controlled within 85 dBA. Contractor shall identify noise areas where noise levels exceed prescribed safe level for arranging for appropriate Engineering revision. Where this is not feasible, appropriate Earmuffs or protectors shall be provided to workmen ensuring those wear them exposed to noise levels beyond safe levels. Periodic hearing acuity tests shall be conducted on such persons exposed to high noise levels to ensure that they do not suffer any hearing impairment` as per requirements of IS 8520: 1977

3.2 Manual handling & ergonomics:

a) Contractor shall have procedures to identify risks involved in manual handling, operation and tasks. He shall ensure appropriate training to prevent any possible injury. Full use of mechanical aids shall be made to avoid risks arising out of such manual handling. Employees shall be adequately trained on such manual tasks and related safety precautions to reduce the risk of injury to personnel engaged in such work.

b) Contractor shall undertake ergonomic study of manual operations to prevent musculoskeletal injury during manual handling, besides visual fatigue and mental stress giving considerations to matters such as seating, lighting and ventilation, etc.

4.0 FIRE PROTECTION AND PREVENTION:

4.1 General Requirements:

a) Risk assessments shall be carried out to identify potentially vulnerable areas to provide sufficient quantities of correct type of extinguishers and ancillary equipment to deal with various types of fire hazards.

b) Where required by the contract, Contractor shall provide appropriate type of extinguishers close to areas of fire hazard but not too close such that they are cut off from use during a fire. Water based extinguishers shall not be positioned close to or used on electrical equipment.

c) Extinguishers shall be marked / labelled and recorded with location particulars in a register. They shall be inspected at monthly intervals to ensure they are in

operable sound condition. There shall be a systematic plan for servicing, repairing and recharging fire extinguishers and for recording such dates on the register and equipment.

d) The location of fire fighting equipment shall quickly and easily be identifiable especially in emergencies in a conspicuous manner painted as high as possible to identify the location of the extinguisher to prevent it from being obscured by machinery and goods stacked in front and to return the equipment to its location after emergency use in other locations. In order to ensure this, "Keep Clear" area shall be demarcated and maintained. Location plans of extinguishers and fire-fighting equipment shall be prominently displayed when desired by the Employer.

e) SR and SA shall be trained on fire fighting techniques who shall co-ordinate and control fire protection and prevention programmes.

f) Where required by contract, Contractor shall maintain alarm systems powered by mains and by battery for back up. Where required by the Contract, emergency lighting shall be provided to aid evacuation in poor lighting conditions following the alarm. The alarm system shall be made known to all employees.

g) A clear written procedure for action in the event of fire should be produced. Fire teams and Hose teams shall be identified and their responsibilities during emergencies shall be detailed in writing. Personnel shall be trained on their fire duties and use of fire-fighting equipment. Regular drills shall be conducted to test procedures and to validate them. Fire instructions and emergency procedures shall be displayed throughout the premises. Emergency response procedures are detailed below under Clause 5.0.

h) A means of escape shall be provided in all work areas and storages and maintained and kept free from obstruction. All exits shall be clearly marked and kept unlocked whilst the premises are in use. Escape routes shall be protected from fire.

4.2 **Security:**

a) Where required by the contract, Security shall do all that is reasonably practicable to ensure the safety of employees and property of the company in the face of accidents by fighting fires, and containing losses due to pilferage, theft, vandalism and industrial espionage both by employees external elements. Security personnel shall be appropriately competent, receive adequate safety training. Security shall routinely report on a standardised basis on aspects such as violation of fire-protection rules, use of alcohol and narcotic drugs, condition of security fencing, floodlighting and storage, etc.

b) Where the project is located where a number of other companies are in operation, Contractor shall plan for mutual assistance programmes in cases of emergencies, as are practiced in the area in conjunction with Employer.

c) Where common boundaries exist between companies, contractor in conjunction with Employer shall co-ordinate security control over common factors such as Floodlights, Fencing, and pipelines containing gas, fuel and electricity.

d) Security shall be represented in Safety committee through a safety appointee nominated from the area.

5.0 EMERGENCY PLANNING / EMERGENCY RESPONSE (ER)

a) Contractor shall plan to deal with emergencies (ER) specific to the job site. ER shall be written and communicated to all employees. ER shall identify for the potential and responses to incidents and emergency situations and for preventing and mitigating the likely illness and injury that may be associated with them.

b) The Contractor shall review his emergency preparedness and response plans and procedures in particular after occurrence of incidents or emergency operations.

c) Contractor shall designate his emergency team with their duties during emergencies defined, including those of the hose teams, medical personnel, first-aiders and security. Contractor shall maintain a procedure as to how his emergency organisation shall liaise with Employer's representatives in ER.

d) The Contractor shall also periodically test such emergency procedures by conducting Mock-drills and use the experience for updating the emergency Plan and for training the Employees on the perceived competence needs.

e) The emergency Response Plan of the Contractor shall be under the control of the SR who shall be able to co-ordinate with Employer for liasing with Government agencies, neighbouring industries and community

f) The plans shall be designed to allow people to work under disaster conditions when normal services such as telephone, water, light, power, transport and sanitation are not available and first aid and fire fighting facilities are not able to cope with sudden demand on services.

g) The telephone numbers, ambulance, Police; Managers and Employer's key executives shall be prominently displayed in the identified Emergency Response Centre.

6.0 PREMISES AND HOUSE -KEEPING

6.1 Orderly work-place

Contractor shall maintain a well-managed safe working place in sound clean condition. Contractor shall ensure that there is a place for everything and everything is in its place so that optimum use is made of valuable floor space with commensurate cleanliness and reduced handling time. He shall ensure that his entire infrastructure including temporary and semi-temporary buildings are kept clean and have good repair.

6.2 Good lighting (natural and artificial):

Contractors shall provide lighting (natural or artificial) to enable that work processes are carried out safely. Artificial lighting shall be adequate especially

in the nights and emergencies. The lumen levels shall meet the statutory requirements.

6.3 Ventilation (natural and artificial):

Contractor shall ensure that workplaces are ventilated with at least prescribed amount of clean or cleaned fresh air of a suitable temperature, especially where toxic or irritating substances are present such as welding, vehicle exhaust fumes, irritating dusts, organic solvents or any other inimical atmosphere creating health hazards or safety.

6.4 Welfare and hygiene facilities:

Contractor shall provide welfare facilities to ensure a high standard of cleanliness for all activities and rest. Contractor shall provide adequate facilities for his employees such as ablutions, toilets, change rooms, kitchens and cafeterias in a clean and hygienic state.

6.5 Pollution to ground, air and water:

Contractor shall strive to exceed established minimum performance norms in waste and pollution control. All drains shall be identified as clean water and foul water to aid non-armful disposal.

6.6 Traffic routes and Aisles:

Contractor shall arrange to separate pedestrian and vehicular including material handling equipment traffic wherever possible and maintain the routes clear of obstruction. To ensure safety of user's clear painted demarcation is encouraged as a discipline to be enforced.

6.7 Stacking and storage practice:

a) Contractor shall ensure stacked material is bonded on a stable and level footing capable of carrying the mass of the stack. Adequate clearances shall be provided between the sides of the stack and top to facilitate unimpeded access to service equipment like overhead wiring, cranes, forklifts, fire fighting equipment and hoses. Circular items shall be sufficiently choked with wedges and not with odd bits of materials. Freestanding stacks of gunny bags and sacks such as cement bags shall be stacked to prescribed safe-stack heights with layers formed for stable bonding, preventing slippage causing accidents. Stacking against walls shall not be permissible.

b) Contractor shall maintain the premises and surrounding areas in clean and clear manner with safe access and egress. There shall be sufficient and adequate storage racks, shelving, bins, pallets and material handling equipment to stack his construction materials such as pipes, structures and his construction enabling materials. Unwanted materials shall be promptly moved away for efficient material movement.

6.8 Storage of Hazardous materials:

a) Hazardous materials shall be stored on solid bases. Solid bases shall include compacted earth, pallets, concrete or asphalt platforms or paving. Hazardous

materials shall be stored, stacked and secured to prevent toppling, spillage or other unintended dislodgement. Aisles and clearances shall be as detailed under 6.6 above. Hazardous materials shall be stacked in such a manner that an observer standing in the aisle can read their labels and legends

b) Each hazardous material contained hall be identified by a legible or legend as per governing statute, code or regulation. The label shall identify the item, quantity and appropriate warnings.

c) Hazardous materials which if brought in contact with each other could react or pose equal or greater hazard than either material stored alone shall be stored at a distance not lesser than twenty feet apart.

d) Warnings shall be posted and maintained in a legible condition at all access points clearly defining the specific hazardous nature of the stored materials such as "Corrosive", Flammable", "Explosive", “Oxidising”, “Compressed gas" or other hazardous nature.

e) Where hazardous materials are unloaded in Contractor's storage maintained at site in a semi-permanent installation, such installations shall be approved by relevant statutory bodies. Copies of licences for storage shall be lodged with Employer. The Containers and storages shall display quantities stored with name of the hazardous material and the UN Hazard classification label in prescribed colour code prominently painted in a conspicuous manner.

f) Contractor shall inspect the hazardous storages and installations on a daily basis and hall undertake any requisite preventive action necessary to avoid safety risks

6.9 Storage of flammable / explosive Materials:

a) Contractor shall secure flammable and / or explosive materials against accidental ignition.

b) Storage facilities for flammable liquids such as Petrol, Diesel, Kerosene and Lubricants as well as the quantities stored shall meet the legal and statutory requirements. They shall be stored in approved fire-resistant rooms with a sump of sufficient volume to contain any spillage.

c) The electrical fittings shall be flame -proof and on a strict maintenance schedule.

d) Containers shall be appropriately bonded in receptacles into which low flash point fuel is decanted.

6.10 Compressed gas cylinders

Compressed gas cylinders shall be stored and secured in the upright position at safe distances shielded from welding and cutting operations. Compressed gas cylinders in storage shall be shut off and torches, hose and manifolds removed and capped. Cylinders shall be periodically checked for leakages. Storage shall meet requirements of Gas Cylinder Rules 1981. Compressed gas storages shall be provided with safety relief valves, safety valves and rupture disc to protect

them from overpressures and shall be appropriately designed to ensure their continued availability in the face of process changes.

6.11 Scrap and Refuse Bins-Removal System

Contractor shall ensure that he has sufficient waste bins that are identified for different wastes and maintained in clearly demarcated areas. Wastes with oily or other ignitable materials such as Oily cotton wastes and Hand gloves shall be stored separately with covers to prevent fires and shall be made of metal. Different Wastes shall be segregated and stored separately and disposed off. They shall be emptied at routine intervals to prevent that they do not overflow with wastes.

BHUTAN POWER CORPORATION LIMITED

(*An ISO 9001:2015, ISO 14001:2015 & OHSAS 18001:2007 Certified Company*)

Distribution Construction Department
Renewable Energy Division
Thimphu: Bhutan

Bidding Document

For

Supply, Install, Testing and Commissioning of 180kW Grid-tied ground mounted Solar Power Project at Rubessa under WangduePhodrang district, Bhutan

Tender No. 08/BPC/RED/DCD/2020/Vol-I/46 Dt. 07/09/2020

Volume 2 Part-1 – Guaranteed Technical Particulars (GTP) & Forms

September 2020

FORMS

1. FORM OF BID

NAME OF CONTRACT: Supply, Install and Commissioning of 180kW Solar Power Project at Rubessa, Wangdiphodrang

To: Manager,
Renewable Energy Division,
Distribution Construction Department
Bhutan Power Corporation Limited,
Yarden Lam, PO Box No. 580,
Thimphu: Bhutan.

Dear Sir,

1. Having examined the Condition of Contract and Addenda for the execution of the above-named works, we, the undersigned, offer to execute and complete such works and remedy any defects therein in conformity with the Condition of Contract, Annexure and Addenda for the sum of Nu. _____ ___(_____ ____) as specified in the Appendix to Bid or such other sums as may be ascertained in accordance with the said Conditions.

2. We undertake, if our Tender is accepted, to commence the Works as soon as is reasonably possible after the receipt of the Engineer's notice to commence, and to complete the whole of the Works comprised in the Contract within the time stated in the Appendix to Tender.

3. We agree to abide by this Tender for the period of 90 days (Ninety Days) from the date fixed for receiving the same and it shall remain binding upon us and may be accepted at any time before the expiration of that period.

4. The Bid is submitted under our covering letter reference _____dated _____ and the completed Bid documents and other information, required by the Instruction to Bidders, which are enclosed therewith all of which shall be read and construed as forming part hereof.

5. Unless and until a formal Agreement is prepared and executed this Tender, together with your written acceptance thereof, shall constitute a binding contract between us.

6. We understand that you are not bound to accept the lowest or any tender you may receive.

Dated this _____ Day of _____2020

Signature _____ in the capacity of _____

Duly authorized to sign tenders for and on behalf of _____

(IN BLOCK CAPITALS)

Address _____

Witness _____

Address _____

Occupation _____

2. APPENDIX TO BID

The bidders shall fill the Appendix to Bid.

	Sub clause	
Amount of Performance Security price	10.1	Ten (10) percent of the contract
Time for Completion	25.1	Five (5) months from the date of handing over of the site
Amount of Liquidated Damages	27.1	0.1% of contract price for each day of delay in completion.
Limit of Liquidated Damages	27.1	Ten (10) percent of the total Contract price or the executed Contract Price, whichever is lower.
Defects Liability Period	1.1.11	One (1) year from the taking over Of the works
Retention Money	33.7	Ten (10) percent of the interim payment certificates

3. FORM OF BID SECURITY (BANK GUARANTEE)

WHEREAS, _____[Name of Bidder] (hereinafter called "the Bidder") has submitted his bid dated_____[date] for the "Supply, Install and Commissioning of 180kW Solar Power Project at Rubessa, Wangdiphodrang" (hereinafter called " the Bid").

KNOW ALL MEN by these presents that We _____[Name of Bank] of _____ [Name of Country] having our registered office at (hereinafter called the " Bank") are bound unto the sum of _____[Mention amount in figure and in words] for which payment well and truly to be made to the said Employer, the Bank binds himself, his successors and assigns by these presents.

SEALED with the Common Seal of the said Bank this _____day of 2020.

THE CONDITIONS of this obligation are:

If the Bidder withdraws his Bid during the period of Bid validity specified it the Form of Bid: or

If the Bidder does not accept the correction of arithmetical errors of his bid price in accordance with the Instruction of Bidders: or

If the Bidder having been notified of the acceptance of his Bid by the Employer during the period of bid validity:

a) fails or refuses to execute the Form of Agreement in accordance with the Instruction to Bidders, if required; or
b) fails or refuses to furnish the Performance Security, in accordance with the Instruction to Bidders,

we undertake to pay to the Employer up to the above amount upon the receipt of his first written demand, without the Employer having to substantiate his demand, provided that in his demand the Employer will note that the amount claimed by him is due to him owing to the occurrence of one or both of the two conditions, specifying the occurred condition or conditions.

This Guarantee will remain in force up to and including the date _____days beyond the period of bid validity as stated in the instruction to bidders or as it may be extended by the Employer, notice of which extensions(s) to the Bank is hereby waived. Any demand in respect of this Guarantee should reach the Bank not later than the above date.

DATE _____ SIGNATURE FO THE BANK _____

WITNESS _____ SEAL _____
(Signature, Name and Address)

4. AGREEMENT (To be used later)

This Agreement made on the _____day of _____ between _____ (hereinafter called "the Employer") of the one part and _____ (hereinafter called "the Contractor") of the other part.

Whereas the Employer is desirous that certain Works should be executed by the Contractor namely _____ thereof and has accepted a bid by the Contractor for the execution and completion of such Works and the remedying of any defects therein in the sum of _____ (herein called the "Contract Price")

Now it is agreed as follows:

1. In this Agreement words and expressions shall have the same meanings as are respectively assigned to them in the Conditions of Contract hereinafter referred to.

2. The contract shall consist of this contract agreement form and the following documents and the drawings, specifications and other documents referred to therein (herein called the "Contract Documents"), all of which by this reference are incorporated herein and made part thereof. The following document shall be deemed to form and be read and construed as part of this Agreement, viz:

    i. This Agreement
    ii. The Letter of Acceptance;
    iii. The said Bid along with clarifications and correspondence from the date of Bid Opening to signing of Contract Agreement;
    iv. The Technical Specifications and the Scope of Works as indicated in BPC's bid document read along with all amendments thereof;
    v. The Drawings; and
    vi. The Priced Bill of Quantities.
    vii. Any other document forming Part of the Contract.

3. In consideration of the payments to be made by the Employer to the Contractor as hereinafter mentioned the Contractor hereby covenants with the Employer to execute and complete the Works and remedy any defects therein in conformity in all respects with the provisions of the Contract.

4. The Employer hereby covenants to pay the Contractor in consideration of the execution and completion of the Works and the remedying of defects therein the Contract Price or such other sum as may become payable under the provision of the Contract at the times and in the manner prescribed by the Contract , the total estimated contract price and details of which are indicated in the Contract Price Schedule enclosed, all the unit rates therein being firm and not subject to any Price Variation provisions of the Original Contract.

5. Any notice under the contract shall be in the form of a letter, or facsimile. Notices to either party shall be given to the following address, unless subsequently modified by either party in writing at the following address:

   Client's Address
   The Manager,
   Renewable Energy Division
   Distribution Construction Department
   Bhutan Power Corporation Limited
   Yarden Lam, PO Box No. 580,
   Thimphu: Bhutan
   Tel: +975-17670073
   Email: pema_wangchuk@bpc.bt

   And notice to the Contractor shall be properly addressed to:

   Tel:
   Fax:
   Email:

IN WITNESS WHEREOF, the parties hereto have caused the agreement to be signed in their respective names as on the date written.

SIGNED, SEALED AND DELIVERED

Binding Signature of Employer ***Binding Signature of Contractor***

Signed in the presence of:

Witness of Employer ***Witness of Contractor***

5. PERFORMANCE BANK GUARANTEE (To be used latter)

To: _____ (Name of Employer)
_____ (Address of Employer)

WHEREAS _____ [Name and address of Contractor] (hereinafter called "the Contractor") has undertaken, in pursuance of Contract No. _____ dated _____ to execute the complete works related to Supply, Install and Commissioning of 180kW Solar Power Project at Rubessa, Wangduiphodrang (hereinafter called "the Contract");

AND WHEREAS it has been stipulated by you in the said contract that the Contractor shall furnish you with a Bank Guarantee by a recognized Bank for the same specified therein as security for compliance with his obligations in accordance with the Contract.

AND WHEREAS we have agreed to give the Contractor such a Bank Guarantee;

NOW THEREFORE, we hereby affirm that we are the Guarantor and responsible to you, on behalf of the Contractor, up to a total of _____(amount of Guarantee) _____(in word), such sum being payable in the currency in which the Contract Price is payable, and we undertake to pay you , upon your first written demand and without cavil or argument, any sum or sums within the limits of _____(amount of Guarantee) as aforesaid without your needing to prove or to show grounds or reasons for your demand for the sum specified therein.

We hereby waive the necessity of your demanding the said debt from the Contractor before presenting us with the demand.

We further agree that no change or addition to or other modification of the terms of the Contract or of the Works to be performed there under or of any of the Contract documents which may be made between you and the Contractor shall in any way release us from any liability under this guarantee, and we herby waive notice of any such change, addition or modification.

This guarantee shall be valid until the date of taking over of the works and release of Performance Certificate by the Employer. A separate Bank Guarantee covering defects liability period will be necessary.

SIGNATURE AND SEAL OF THE GUARANTOR _____
NAME OF BANK _____
ADDRESS _____
DATE _____

6. BANK GUARANTEE FOR ADVANCE PAYMENT (To be used latter)

To: _____ (Name of Employer)
_____ (Address of Employer)
_____ (Name of the Contract)

Gentlemen:

In accordance with the provisions of the Terms & Condition of Contract, _____ [Name and address of Contractor] (hereinafter called "the Contractor") shall deposit with the _____ (name of Employer), a bank guarantee for advance under the said Clause of the Contract in an amount of _____ (amount of Guarantee) _____ (in words).

We, the _____(bank or financial institutions), as instructed by the Contractor, agree unconditionally and irrevocably to guarantee as primary obligator and not as Surety merely, the payment to _____(name of Employer), on his first demand without whatsoever right of objection on our part and without his first claim to the Contractor, in the amount not exceeding _____(amount of Guarantee) _____ (in words).;

We further agree that no change or addition to or other modification of the terms of the contract or of works to be performed thereunder or of any of the Contract documents which may be made between, _____(name of Employer), and the Contractor, shall in any way release us from any liability under this guarantee, and we hereby waive notice of any such change, addition or modification.

This guarantee shall be valid for the whole contract period and until the advance payments are fully recovered.

This guarantee shall remain valid and in full effect from the date of the advance payment under the Contract until _____(name of Employer), received full repayment of the same amount from the Contractor.

SIGNATURE AND SEAL OF THE GUARANTOR
_____

NAME OF BANK _____
ADDRESS _____
DATE _____

7. DEVIATIONS FROM AND EXCEPTION TO BID DOCUMENT

The Bidder shall specify below, in detail, all deviations from and exceptions to the Bid Document. Any entry shall be referenced to the Bid Document Clause No. to which they refer.

The Bidder shall be deemed to be compliant with the content and intent of the Bid Document except in respect of deviations and exceptions listed in this Schedule.

No deviation from and exception to the Bid Document shall be made subsequently to the Contract without the written approval of the Employer.

Clause No.	Details of Deviation/Exception	Reasons for Deviation/Exception

Declaration: This page and attached ……. Pages of deviations from the Bid Document is a complete record of such deviations.

In case NO DEVIATION is mentioned here and deviation of clauses/specification is mentioned else where, then it will be taken as a deviation.

Signature of Bidder: ……

Place & Date ……

8. CONTRACOTR'S KEY PERSONNEL

The Bidder shall submit an organization structure chart and summaries below the names of all key personnel whom they or their major sub-contractors propose to employ on the works together with a brief resume of their qualification and experience. These persons shall be available at the site and changes can be done only after due approval of BPC.

Organization Structure Ref. No.	Position	Name	CV or Resume of previous Experience, Responsibilities and Employer
	Project Manager Project Engineer Site Supervisor		

The duties and responsibilities of the above personnel should be shown on the organization structure chart (showing head office and site responsibility of key personnel). Site and Office organogram shall be submitted.

Signature of Bidder: ……..

Date: ……..

9. IMPLEMENTATION METHODOLOGY

WORK SCHEDULE

The bidder shall provide a detailed programme covering installation and commissioning phases of the project. This programme shall conform to the key dates in the Bidding Document.

The programme shall include a bar chart of the principal quantities of work forecast for execution monthly, and payments expected to be made in connection herewith in accordance with the Condition of Contract.

The programme shall be made using a Project Management software like Microsoft Project and submit with the bid. The Bidder shall also submit soft copy of the detail schedule to the Engineer/Employer for approval after 7 days of the signing of the contract agreement.

10. BIDDER'S EXPERIENCE

The bidder shall submit Completion Certificates of the completed projects in the last 10 years. The Completion Certificates should include information necessary to assess the bidder's experience and performance. The bidder also may submit the work completion certificates, which is optional.

Name of the project completed	Client	Contract Value	Year of Completion

11. Current Contract Commitments/ Works in Progress

The bidder shall submit information on their current commitments on all the contracts that have been awarded, or for which a letter of intent or acceptance has been received, or for contracts approaching completion.

Name of the project & Client	Value of Outstanding works (Nu.)	Estimated completion date	Remarks

12. Bidder's Annual Turnover

The bidder shall submit information on Annual Turnover in the last 3 – 5 years (in construction only). Supporting documents should be attached.

Year	Turnover (Nu.)	Remarks

13. Credits, Loans and Overdraft Facilities.

The bidder shall submit information on bank facilities from any reputed bank in Bhutan.

Sources of credit line	Amount (Nu.)	Remarks

14. Proposed Site Organization / Management.

The bidder shall submit the site organization & project management chart. Attached separate sheets.

15. Sub-Contracting of Specialized Work

The bidder shall enter in this Schedule a list of the sections and approximate value of the work for which he proposes to use subcontractors, together with the names of the addresses of the proposed subcontractors. The bidder shall also enter a statement of similar works previously executed by the proposed subcontractors including description, location and value of work, year completed, and name and address of the employer/engineer. Notwithstanding such information the bidder, if awarded the contract, shall remain entirely and solely responsible for the satisfactory completion of the works.

16. Contractor's Declaration

A. LICENCE, EXPERIENCE AND WORK IN HAND.

1. Name of Contractor : _____
2. Address and Tel. No. : _____
3. Name of Construction Firm : _____
4. Trade License No and its Validity (Photocopy to be attached) : _____
5. CDB Registration No. and its Validity (Photocopy to be attached) : _____
6. Category : _____
7. Past experience in similar Works

   State **YES** OR **NO**

   (**If yes**, attach copy of Experience Certificate) : _____
8. Works in hand:

   (1) _____

   (2) _____

   (3) _____

I, hereby certify that the information given in this form is true, complete and correct.

(Signature of the Contractor)
Date:

17. INTEGRITY PACT

1 General

Whereas **……**representing **……..**, the Royal Government of Bhutan, hereafter referred to as the Employer on one part and …… representing the …… on the other part, herby execute this agreement as follows:

This agreement should be part of the tender document, which shall be signed and submitted along with the tender document. The head of the employing agency/or his authorized representative should be the signing authority. For the Bidders, the Bidder himself or his authorized representative must sign the Integrity Pact (IP). If the winning Bidder had not signed during the submission of the bid, the tender shall be cancelled.

2 Objectives

Now, therefore, the Employer and the Bidder agree to enter into this pre-contract agreement, hereinafter referred to as Integrity Pact, to avoid all forms of corruption by following a system that is fair, transparent and free from any influence/unprejudiced dealings prior to, during and subsequent to the currency of the contract to be entered into with a view to:

2.1 Enabling the Employer to obtain the desired works at a reasonable and competitive price in conformity with the defined specifications of the goods and services; and

2.2 Enabling bidders to abstain from bribing or any corrupt practice in order to secure the contract by providing assurance to them that their competitors will also refrain from bribing and other corrupt practices and the Employer will commit to prevent corruption, in any form by their officials by following transparent procedures.

3 Commitments of the Employer:

The Employer commits itself to the following:

3.1 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, favor or any material or immaterial benefit or any other advantage from the Bidder, 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.

3.2 The Employer further confirms that its officials has not favored any prospective Bidder in any form that could afford an undue advantage to that particular Bidder during the tendering stage and will further treat all Bidders alike.

3.3 All the officials of the Employer shall report to the Head of the employing agency or an appropriate Government office any attempted or completed violation of the clauses 3.1 and 3,2.

3.4 Following report on violation of clauses 3.1 and 3.2 by official (s), through any source, necessary disciplinary proceedings, or any other action as deemed fit, including criminal proceedings may be initiated by the Employer and such a person shall be debarred from further dealings related to the contract process. In such a case while on enquiry is being conducted by the Employer the proceedings under the Contract would not be stalled.

4 **Commitments of Bidders**

The Bidder commits himself to take all measures necessary to prevent corrupt practices, unfair means and illegal activities during any stage of his 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 commits himself to the following:

4.1 The Bidder will not offer, directly or through intermediaries, any bribe, gift, consideration, reward favor, 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.

4.2 The Bidder further undertakes that he has not given, offered or promised to give, directly or indirectly any bribe, gift, consideration, reward, favor, 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 the Government for showing or forbearing to show favor or disfavor to any person in relation to the Contract or any other contract with the Government.

4.3 The Bidder will not collude with other parties interested in the contract to preclude the competitive bid price, impair the transparency, fairness and progress of the bidding process, bid evaluation, contracting and implementation of the contract.

4.4 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 of their family members, agents, brokers or any other intermediaries in connection with the Contract and the details of services agreed upon for such payments.

5 **Sanctions for violation**

The breach of any aforesaid provisions or providing false information by the employers, including manipulation of information by evaluators, shall face administrative charges and penal actions as per the existing relevant rules and laws.

The breach of the Pact or providing false information by the Bidder or any one employed by him or acting on his behalf (whether with or without the knowledge of the Bidder) or the commission of any offence by the Bidder or any one employed by him or acting on his behalf, shall be dealt with as per the provisions of the Penal Code of Bhutan, 2004, and the Anti-Corruption Act, 2006.

The Employer/relevant agency shall also take all or any one of the following actions, whenever required:

5.1 To immediately call off the pre-contact negotiations without assigning any reason or giving any compensation to the Bidder. However, the proceedings with the other Bidder(s) would continue.

5.2 To immediately cancel the Contract, if already awarded/signed, without giving any compensation to the Bidder.

5.3 The Earnest Money/Security Deposit/Performance bond shall stand forfeited.

5.4 To recover all sums already paid by the Employer.

5.5 To encash the advance bank guarantee and performance bond/warranty bond, if furnished by the Bidder, in order to recover the payments, already made by the Employer, along with interest.

5.6 To cancel all or any other Contracts with the Bidder.

5.7 To debar the Bidder from entering into any bid from the government of Bhutan as per the Debarment Rule.

6 **Conflict of Interest**

6.1 A conflict of interest involves a conflict between the public duty and private interests (for favor or vengeance) of a public official, in which the public official has private interest which could improperly influence the performance of their official duties and

responsibilities. Conflict of Interest would arise in a situation when any concerned members of both the parties are related either directly or indirectly, or has any association or had any confrontation. Thus, conflict of interest of any tender committee member must be declared in the prescribed form (attached).

6.2 The Bidder shall not lent to or borrow any money from or enter into any monetary dealings or transactions, directly or indirectly, with any committee member, and if he does so, the Employer shall be entitled forthwith to rescind the Contract and all other Contracts with the Bidder.

7 **Examination of Books of Accounts**

7.1 In case of any allegation of violation of any provisions of this Integrity Pact or payment of commission, the Employer/authorized persons or relevant agencies shall be entitled to examine the Books of Accounts of the Bidder and the Bidder shall provide necessary information of the relevant financial documents and shall extend all possible help for the purpose of such examination.

8 **Monitoring and Arbitration**

8.1 The respective procuring agency shall be responsible for monitoring and arbitration of IP as per the Procurement Rules.

9 **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.

10 **Validity**

10.1 The validity of this Integrity Pact shall cover the tender process and extend until the completion of the Contract to the satisfaction of both the Employer and the Bidder.

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 intentions.

We, hereby declare that we have read and understood the clauses of this agreement and shall abide by it. Further, the information provided in this agreement are true and correct to the best of our knowledge and belief.

The parties hereby sign this Integrity Pact at **…….** on **…….**

…….. ……

EMPLOYER **BIDDER**

Witness: Witness

1._____ 1. _____

2._____ 2._____

Legal Officer/Internal Auditor

GUARANTEED TECHNICAL PARTICULARS

Sl. No	Description			Unit	Particulars
1	Solar Photovoltaic Modules	1.1	Applicable Standards		
		1.2	Make and Model		
		1.3	Technology type		
		1.4	Power Rating	W_p	
		1.5	Module Efficiency	%	
		1.6	Cell Efficiency	%	
		1.7	Fill Factor	%	
		1.8	No. of cells per module	Nos	
		1.9	Junction Box:		
		1.9.1	Material		
		1.9.2	Bypass diode	Yes/No	
		1.9.3	UV resistant	Yes/No	
		1.9.4	Ingress Protection (IP) Degree	IP	
		1.10	Power Tolerance (Only +ve tolerance acceptable)	%	
		1.11	Temperature co-efficient of:		
		1.11.1	Power	%	
		1.11.2	Voltage	%	
		1.11.3	Current	%	
		1.12	Glass Material		
		1.13	General Data		
		1.13.1	Dimension (W x H x D)	mm	
		1.13.2	Weight	kg	
		1.14	RF identification tag for each solar module	Yes/No	
2	PV Array/ Stringing	2.1	Cable size and type used for PV Module Interconnection		
		2.2	Type of connector used (MC4/ TS4)		
3	String Combiner Box	3.1	Enclosure		
		3.1.1	Make and Model		
		3.1.2	Degree of Protection	IP	
		3.1.3	Material Type		
		3.1.4	Withstanding Voltage	V_{dc}	
		3.1.5	Withstanding Temperature	^0C	
		3.1.6	Accessories mounting arrangement		

Sl. No	Description			Unit	Particulars
		3.1.7	Numbers of strings entry	Nos	
		3.2	Cable Entry and Exit:		
		3.2.1	Position		
		3.2.2	Cable entry and exit connector type		
		3.2.3	Cable gland	Yes/No	
		3.3	DC Input		
		3.3.1	Input Connection		
		3.3.2	Fuse Type		
		3.3.3	Fuse Size		
		3.4	Surge Protection Device (SPD): 3 Nos pluggable type		
		3.4.1	Type		
		3.4.2	Make and Model		
		3.4.3	Rating (V, kA)		
		3.5	Earthing		
		3.5.1	Earthing terminal	Yes/No	
		3.6	Terminals, Lugs and Bus Bar		
		3.6.1	Material		
		3.7	Applicable Standards		
4	Grid-Tied String Inverter	4.1	Type		
		4.2	DC Input		
		4.2.1	Maximum input voltage	V	
		4.2.2	Operating voltage range	V	
		4.2.3	Start voltage	V	
		4.2.4	MPP voltage range	V	
		4.2.5	Rated voltage	V	
		4.2.6	No. of MPP tracker	Nos	
		4.2.7	Max. input current per MPPT	A	
		4.2.8	Connection type		
		4.2.9	Type II SPD	Yes/ No	
		4.2.10	String Fuse Rating	A	
		4.2.11	DC Switch Rating	A	
		4.2.12	String Monitoring	Yes/ No	
		4.3	AC Output		
		4.3.1	Nominal AC Power Output	kW	
		4.3.2	Phase		

Sl. No	Description			Unit	Particulars
		4.3.3	Adjustable AC voltage range	%	
		4.3.4	Frequency range	%	
		4.3.5	THD	%	
		4.3.6	Switching		
		4.4	General Electrical Data		
		4.4.1	Maximum Efficiency	%	
		4.4.2	Night mode consumption	W	
		4.5	Protection		
		4.5.1	DC Side		
		4.5.2	AC Side		
		4.5.3	Isolation Switch	Yes/No	
		4.5.4	Provision for body earthing	Yes/No	
		4.6	LCD Display Parameters		
		4.6.1	General Displays		
		4.6.2	DC Parameters		
		4.6.3	On Grid Connected Mode		
		4.7	Switching Devices		
		4.8	Control		
		4.9	Interface (Communication Protocol)		
		4.10	Storage of Data		
		4.11	General Data		
		4.11.1	Ingress Protection (IP) Degree	IP	
		4.11.2	Cooling Method		
		4.11.3	Dimension (W x H x D)	mm	
		4.11.4	Weight	kg	
		4.12	Applicable Standards		
5	415V LT Panel Switchgear	5.1	Make and Model		
		5.2	Enclosure		
		5.2.1	Ingress Protection (IP) Degree	IP	
		5.2.2	Dimension (W x H x D)	mm	
		5.2.3	Material Type		
		5.2.4	Withstanding Voltage	V	
		5.2.5	Withstanding Temperature	^{0}C	
		5.3	Incoming MCCBs		
		5.3.1	Make and Model		
		5.3.2	Rating (A, kA)	A, kA	

Sl. No	Description			Unit	Particulars
		5.4	Outgoing MCCBs		
		5.4.1	Make and Model		
		5.4.2	Rating (A, kA)	A, kA	
		5.5	Busbar Chamber		
		5.5.1	Make		
		5.5.2	Model		
		5.5.3	Rating	A	
		5.5.4	No. of strips	Nos	
		5.5.5	Strip size	mm	
		5.6	Enclosure		
		5.6.1	Ingress Protection (IP) Degree	IP	
		5.6.2	Dimension (W x H x D)	mm	
		5.6.3	Material Type		
		5.6.4	Withstanding Voltage	V	
		5.6.5	Withstanding Temperature	^{0}C	
		5.7	Cable gland	Yes/No	
		5.8	Surge Protection Device (SPD)		
		5.8.1	Type		
		5.8.2	Make and Model		
		5.8.3	Rating (V, kA)	V, kA	
		5.9	Earthing		
		5.9.1	Earthing terminal	Yes/No	
		5.9.2	Body Earthing provision	Yes/No	
		5.10	Applicable Standards		
6	11kV Outdoor ICOG VCB Panel	6.1	Switchgear Panel Data		
		6.1.1	Make and Model		
		6.1.2	Installation & Type		
		6.1.3	Insertion of Circuit Breaker		
		6.1.4	Position of circuit breaker in the panel		
		6.1.5	Secondary Contacts		
		6.1.6	Degree of Protection (Enclosure)	IP	
		6.1.7	Degree of Protection (Internal)	IP	
		6.1.8	Rating for Bus Bar	A	
		6.1.9	Space for Current Transformers		
		6.1.10	Space for Potential Transformer		

Sl. No	Description			Unit	Particulars
		6.1.11	Cable Termination Height (from bottom)	mm	
		6.1.12	Applicable Standards		
		6.2	Vacuum Circuit Breakers		
		6.2.1	Make and Model		
		6.2.2	Operating Method		
		6.2.3	Rated Voltage		
		6.2.4	No. of poles	Nos	
		6.2.5	Frequency	Hz	
		6.2.6	Rated Current	A	
		6.2.7	Short-circuit current	kA	
		6.2.8	Making current	kAp	
		6.2.9	Duration of short time current	sec.	
		6.2.10	Insulation level	kVrms	
		6.2.11	Insulation level	kVp	
		6.2.12	Contact travel	mm	
		6.2.13	Opening time	milli sec.	
		6.2.14	Interrupting time	milli sec.	
		6.2.15	Closing time	milli sec.	
		6.2.16	Operating sequence		
		6.2.17	Applicable Standards		
7	Dry-Type Outdoor Step-up Transformer	7.1	Make and Model		
		7.2	Country of origin		
		7.3	Applicable Standards		
		7.4	Rated Power	kVA	
		7.5	Rated No-Load Voltage Ratio (LV/HV)	kV	
		7.6	Type of dry-type transformer		
		7.7	Maximum continuous rating	kVA	
		7.8	Rated frequency	Hz	
		7.9	Number of phases		
		7.10	Type/ Method of cooling		
		7.11	Material of Winding (LV/HV)		
		7.12	Vector Group		
		7.13	Connection (LV/HV)		
		7.14	Class of Insuilation	Class	

Sl. No	Description			Unit	Particulars
		7.15	Avg. Temp Rise of Winding (LV/HV)	Deg.C	
		7.16	No-Load loss at rated voltage and frequency (Max)	kW	
		7.17	Full-Load Loss at Rated Current at 75 Deg.C (Max)	kW	
		7.18	Total loss at rated voltage , rated frequency at 75 Deg.C and at 100% load (Max)	kW	
		7.19	% Impedance at rated current at 75Deg.C	%	
		7.20	Efficiencies at 75 Deg.C at Unity Power Factor		
		7.20.1	At Full load	%	
		7.20.2	At 3/4 Full load	%	
		7.20.3	At 1/2 Full load	%	
		7.21	Regulation at full load at 75 Deg.C		
		7.21.1	At Unity Power Factor	%	
		7.21.2	At 0.8 Power Factor (Lagging)	%	
		7.22	Full wave lightning Impulse Withstand voltage	kV peak	
		7.23	Separate source power - frequency voltage withstand (HV/LV)	kV rms	
		7.24	Degree of protection of enclosure	IP	
		7.25	Weights		
		7.25.1	Core and Winding	kg	
		7.25.2	Enclosure and Fittings	kg	
		7.25.3	Total Weight	kg	
		7.26	Over-all Dimensions including IP65 enclosure		
		7.26.1	Length	mm	
		7.26.2	Breadth	mm	
		7.26.3	Height (With base channel)	mm	
8	Bi-directional HT Trivector	8.1	Make and Model		

Sl. No	Description			Unit	Particulars
	Energy Meter for 11kV	8.2	Applicable Standards		
		8.3	Working voltage/frequency and Power rating	V/Hz/kW	
		8.4	Accuracy Class		
		8.5	Warranty	years	

Bidder needs to include all the necessary components and accessories for proper, efficient and safe operation.

Note: Any technical parameters missed out shall be incorporated by the bidder.

Signature of Bidder

BHUTAN POWER CORPORATION LIMITED

(*An ISO 9001:2015, ISO 14001:2015 & OHSAS 18001:2007 Certified Company*)

Distribution Construction Department
Renewable Energy Division
Thimphu: Bhutan

Bidding Document

For

Supply, Install, Testing and Commissioning of 180kW Grid-tied ground mounted Solar Power Project at Rubessa under WangduePhodrang district, Bhutan

Tender No. 08/BPC/RED/DCD/2020/Vol-I/46 Dt. 07/09/2020

Volume 2 Part-2 – Schedule of Prices

September 2020

SCHEDULE OF PRICES

SCHEDULE OF PRICES

Preamble:

1. Prices shall be filled in indelible ink, and any alteration necessary due to errors, etc., shall be initialed by the bidder.

2. Price shall be fixed and firm for the duration of the Contract.

3. Bid price shall be quoted in the manner indicated and in the currencies specified in the Instructions to Bidders in the Bidding Document.

4. For each item, bidders shall complete each appropriate column in the respective schedules, giving the price breakdown as indicated in the Schedules.

5. Payment will be made to the Contractor in the currency or currencies indicated under each respective item.

6. When requested by the Employer for the purpose of making payments or part payments, valuing variations or evaluation claims, or for such other purposes as the Employer may reasonably require, the Contractor shall provide the Employer with a breakdown of any composite or lump sum items included in the Schedules.

SUMMARY OF PRICES

Sl. #	Schedule	Description	Price in Ngultrum/ Rupees/USD
1	Schedule 1	Supply and Delivery of Electrical Equipment	
2	Schedule 2	Erection, Testing and Commissioning	
3	Schedule 3	Supply and Delivery of Essential Spares	
4	Schedule 4	Civil Works	
GRAND TOTAL			

Amount in words (Nu):

SCHEDULE 1: SUPPLY AND DELIVERY OF ELECTRICAL EQUIPMENTS										
Sl. No	**Description**	**Units**	**Provisional Qty.**	**Unit Price**			**Total FAS excluding BST/CD**	**Provision for BST/CD**			**Total FAS including BST/CD**
				Ex-Works	**FAS excluding BST/CD**	**FAS including BST/CD**		**BST %**	**CD %**	**Value (BST+CD)**	
			1	**2**	**3**	**4**	**5 = 1 x 3**	**6**	**7**	**8 = (6+7) x 1 x 2**	**9 = 1 x 4**
1	345W_p Poly-crystalline Solar PV Module including all its accessories	Nos	522								
2	MC4/TS4 connectors, IP65 or better, UV resistant, 1100V, 25A	Pairs	550								
3	60 kW Grid-Tied String Inverter complete with all accessories as specified in Technical Specifications .	Set	3								
4	6IN-1OUT String Combiner Box (SCB) complete with dc fuse disconnectors, SPDs (type 2) and output switch disconnector as specified in Technical Specification.	Set	3								
5	4IN-1OUT String Combiner Box (SCB) complete with dc fuse disconnectors, SPDs (type 2) and output switch disconnector as specified in Technical Specification.	Set	3								
6	250kVA Outdoor Dry-Type 0.415/11kV Step-up Power Transformer encapsulated inside IP66 enclosure, complete in all respect as specified in Technical Specification	Set	1								

7	SCADA System: Data Sensors, loggers and server 1TB Hard Disk and RS485/Communication plant, optical fibers (1000 meters, 2 Core) and 32" LED Screen for monitoring of the plant in Graphic User Interphase (GUI) Design)	Set	1									
8	415V Outdoor AC Panel with enclosure rating 1P65 or better, fitted with 3 numbers incoming 125A 4Pole 16kA MCCB, 4 strip 600mm 400A Cu. Busbar and 400A 4Pole 36kA outgoing MCCB complete in all respect	Set	1									
9	11kV Outdoor ICOG Panel with enclosure rating IP65 or better, complete with Busbar, VCB, Instrument transformers, relays and Energy Metering as specified in Technical Specs in all respect.	Set	1									
10	Three earthing pits for DC system interconnected with 32sq.mm Copper strip complete in all respects as specified in Technical Specifications & Electrical Drawings	Lump Sum	1									
11	AC Earthing System for AC system complete in all respect as specified in Technical Specifications & Electrical Drawings	Set	1									
12	Lighnting Arrestors	Set	2									

13	Earthing Pits for Lightining Arrestors	Set	2								
Cables											
14	4sq.mm, 1.1kV Grade, Single Core Copper DC Cable	Meter	1200								
15	6sq.mm, 1.1kV Grade, Double Core Copper DC cable	Meter	200								
16	70 sq.mm, 1.1kV Grade, Four Core, Copper PVC Insulated Cable laid inside 40 mm Dia. HDPE Pipe	Meters	150								
17	240sq.mm, 4Core, Copper/ PVC Insulated, Armored 1.1kV Grade Cable	Meters	50								
18	150 sq.mm, 11kV, Three Core, Aluminum Armored XLPE Cable	Meters	150								
Total Work (Nu.)											

Ng. (_____

_____)only

Signature & Seal of Bidder

SCHEDULE 2: ERECTION, TESTING AND COMMISSIONING					
Sl. No	**Description**	**Unit**	**Qty**	**Unit Price**	**Total Price**
			1	**2**	**3 = 1*2**
1	345W_p Poly-crystalline Solar PV Module including all its accessories, stringed with 4 sq.mm cable including MC4/TS4 Connectors.	nos	522		
2	60 kW Grid-Tied String Inverter complete with all accessories in all respect and connection from SCB to Inverter Input.	Set	3		
3	6IN-1OUT String Combiner Box (SCB) complete with dc fuse disconnectors, SPDs (type 2) and output switch disconnector complete in all respect and connection from PV strings to SCBs	Set	3		
4	4IN-1OUT String Combiner Box (SCB) complete with dc fuse disconnectors, SPDs (type 2) and output switch disconnector complete in all respect and connection from PV strings to SCBs	Set	3		
5	250kVA Outdoor Dry-Type 0.415/11kV Step-up Power Transformer encapsulated inside IP66 enclosure, complete in all respect as specified in Technical Specification	Set	1		
6	SCADA System: Data Sensors, loggers and server 1TB Hard Disk and RS485/Communication plant, fibre optic cable (1000 meters, 2 Core) and 32" LED Screen for monitoring of the plant in Graphic User Interphase (GUI) Design)	Set	1		
7	415V Outdoor AC Panel with enclosure rating 1P65 or better, fitted with 3 numbers incoming 125A 4Pole 16kA MCCB, 4 strip 600mm 400A Cu. Busbar and 400A 4Pole 36kA outgoing MCCB complete in all respect and connection from three Inverter outputs to incoming MCCB switches.	Set	1		
8	11kV Outdoor ICOG Panel with enclosure rating IP65 or better, complete with Busbar, VCB, Instrument transformers, relays and Energy Metering complete in all respect and connection from the output of 415V panel including cable laying and coduiting as per electrical drawing.	Set	1		

9	Three Earthing Pits for DC system interconnected with 32sq.mm Copper strip complete in all respects. Connection of all panel bodies and dc earth terminals in the DC earth pit	Lump sum	1		
10	AC Earthing System for AC system complete in all respect as specified and connection of all equipment bodies and AC earthing terminals in AC earth pit.	Lump sum	1		
11	Lighnting Arrestors in all respect including pole, stay wire, earth wire, etc.	Set	2		
12	Earthing Pits for Lightining Arrestors including connections.	Set	2		
Cable Laying and Conduiting in HDPE Pipes					
13	6sq.mm, 1.1kV Grade, Double Core Copper DC cable	Meters	200		
14	70 sq.mm, 1.1kV Grade, Four Core, Copper PVC Insulated Cable laid inside 40 mm Dia. HDPE Pipe	Meters	150		
15	240sq.mm, 4Core, Copper/ PVC Insulated, Armored 1.1kV Grade Cable	Meters	50		
Cable laying underground					
16	150 sq.mm, 11kV, Three Core, Armored Aluminum XLPE Cable	Meters	150		
Total Work (Nu.)					

Ng. (_____
_____)only

Signature & Seal of Bidder

SCHEDULE 3: SUPPLY AND DELIVERY OF ESSENTIAL SPARES											
Sl. No	**Description**	**Units**	**Provisional Qty.**	**Unit Price**			**Total FAS excluding BST/CD**	**Provision for BST/CD**			**Total FAS including BST/CD**
				Ex-Works	**FAS excluding BST/CD**	**FAS including BST/CD**		**BST %**	**CD %**	**Value (BST+CD)**	
			1	**2**	**3**	**4**	**5 = 1 x 3**	**6**	**7**	**8 = (6+7) x 1 x 2**	**9 = 1 x 4**
1	345W_p Poly-crystalline Solar PV Module including all its accessories	Nos	10								
2	MC4/TS4 connectors, IP65 or better, UV resistant, 1100V, 25A	Pairs	50								
3	Fibre-optic cable, 2Core for communication purpose	Meter	100								
4	30A DC Fuse	Nos	30								
Cables											
5	4sq.mm, 1.1kV Grade, Single Core Copper DC Cable	Meter	200								
6	6sq.mm, 1.1kV Grade, Double Core Copper DC cable	Meter	100								
Total Work (Nu.)											

Ng. (_____
_____)only

Signature & Seal of Bidder

SCHEDULE 4: CIVIL WORKS					
Sl. No	**Description**	**Unit**	**Qty**	**Unit Price**	**Total Price**
			1	**2**	**3 = 1*2**
	Site Development				
1	Surface dressing of ground, including removal of vegetations and inequalities < 150mm deep, disposal of rubbish within all lead and lifts - In Ordinary soil	Sqm	**3150.00**		
2	Earth work in excavation over areas, depth >300mm, width >1.5m, area >10 Sq.m on plan, including disposal of excavated earth within all lead and lift & disposed soil to be neatly dressed - Ordinary soil	Cum	**8505.00**		
3	Consolidation of sub-grade with roller, and making good the undulation with earth and re-rolling the sub grade.	Sqm	**3150.00**		
4	Supplying/collection and stacking of stone aggregate,63 - 40 mm	Cum	**315.00**		
5	Supplying/collection and stacking at site, Binding materials.	Cum	**157.50**		
6	Providing and laying Hammer dressed stone edging 150 x 250 mm with stones including excavation, refilling and disposal of surplus earth within all lead	m	**250.00**		
7	Laying wearing course including screening, sorting, spreading to template and consolidation (measurement of wearing course to be taken equal to the quantity of aggregate used, excluding binding materials) (WBM)	Cum	**315.00**		
8	Compaction of WBM using RoadRoller.	Hours	**8**		
9	Providing & laying Random Rubble Masonry with hard stone in foundation & plinth - In cement mortar 1:4				
	Footings				
10	Earthwork in foundation trenches or drains for all width, or area on plan ,including dressing & ramming disposal, of surplus soil within all lead and lift.	Cum	**33.48**		
11	Filling of trenches, side of foundation etc. in layers<200mm using selected excavated earth, ramming within all lead and lift.	Cum	**19.95**		

12	Providing and laying in position plain cement concrete excluding the cost of centering and shuttering - All work upto plinth level. 1:2:4 (1 cement : 2 sand : 4 graded crushed rock 20 mm nominal size) (Footpath)	Cum	**12.00**		
13	Providing and laying in position plain cement concrete excluding the cost of centering and shuttering - All work upto plinth level. -1:3:6 (1 cement : 3 sand : 6 graded crushed rock 20 mm nominal size)	Cum	**3.24**		
14	Providing and laying Hand packed stone filling or soling with stones (for footing and footpath)	Cum	**22.32**		
15	Providing & laying in position reinforced cement concrete 1:1.5:3 (1 cement : 1.5 sand : 3 graded crushed rock 20 mm nominal size) excluding the cost of centering, shuttering and reinforcement all works upto plinth level in **foundation footings,** plinth beams and column portion below plinth beam.	Cum	**4.50**		
16	Providing & fixing Thermo-Mechanically Treated reinforcement bar (Yield Strength 500 MPa) for RCC works from approved list of suppliers (Pelden TMX TMT/Electrosteel/Perfect TMX TMT) including cutting, bending, binding and placing in position complete.	Kg	**2174.38**		
17	Providing & fixing centering and shuttering (formwork), including strutting, propping etc. and removal of formwork- Foundation and plinth etc.	Sqm	**141.60**		
18	Providing and laying 20mm cement paster in cm 1:4	Sqm	**31.50**		
	Steel Frame Structure				
19	Steel work welded, in built up sections, trusses, frame-works including cutting, hoisting, fixing and appl. priming coat of red.-In Tubular	Kg	**14227.03**		
20	Providing & fixing M.S. round hold-down bolts with nuts and washer plates, - bolts (M16*200)	Kg	**179.52**		
21	Providing and applying finishing coats-Aluminium paint, two coats on new work	Sqm	**516.36**		
	Plumbing Works				
22	Excavation in foundation trenches or drains not exceeding 1.5m in width or area 10 sq.m on plan, including dressing & ramming, disposal of surplus soil within all lead & lift. Ordinary soil. (for burying 32mm dia pipe, 0.3m deep)	Cum	**27.00**		

23	Filling of trenches, sides of foundations etc. in layers <200mm using selected excavated earth, ramming etc. within all lead & lift. (for burying 32mm dia pipe)	Cum	**27.00**		
24	Providing & fixing H.D.P.E, Equal Tee butt-welded-type fittings - 32mm	each	**6.00**		
25	Providing & fixing H.D.P.E Elbow - 32mm	each	**4.00**		
26	Providing & laying H.D.P.E pipes, 12.5 PN, including H.D.P.E fittings (excluding trenching, refilling & thrust block) - 32mm	m	**300.00**		
27	Providing & fixing brass full way valve with wheel/ball	each	**6.00**		
28	Providing & fixing plastic tank including all accessories complete- 3000 litre capacity	each	**2.00**		
29	Providing, Supplying & fitting water pump 1.50 HP with automatic sensor (Kirloskar) 0.37 KW including all necessary fittings complete etc.	each	**1.00**		
	Fencing with G.I. Chain Link Mesh				
30	Excavation in foundation trenches or drains not exceeding 1.5m in width or area 10 sq.m on plan, including dressing & ramming, disposal of surplus soil within all lead & lift. Hard Soil	Cum	**51.98**		
31	Filling of trenches, side of foundation etc. in layers<200mm using selected excavated earth, ramming within all lead and lift	Cum	**5.67**		
32	Providing and laying Hand packed stone filling or soling with stones	Cum	**14.18**		
33	Providing and laying in position plain cement concrete excluding the cost of centering and shuttering - All work upto plinth level. -1:3:6 (1 cement : 3 sand : 6 graded crushed rock 20 mm nominal size)	Cum	**18.25**		
34	Providing & laying Random Rubble Masonry with hard stone in foundation & plinth. In cement mortar 1:4	Cum	**32.78**		
35	Providing and laying in position plain cement concrete excluding the cost of centering and shuttering - All work upto plinth level.1:2:4 (1 cement : 2 sand : 4 graded crushed rock 20 mm nominal size)	Cum	**3.78**		
36	Providing & fixing centering and shuttering (formwork), including strutting, propping etc. and removal of formwork- Foundation and plinth etc.	Sqm	**62.90**		

37	Providing and laying 20mm cement paster in cm 1:4	Sqm	**94.50**		
38	Steel work in single sections, trusses, frame-works, including cutting, hoisting, fixing and appl. priming coat of red lead paint - In Tees, angles, flats and channels. (for fencing)	Kg	**1724.95**		
39	Steel work welded, in built up sections, trusses, frame-works including cutting, hoisting, fixing and appl. priming coat of red.-In Tees, angles, flats and channels (for Gate - 2.78Mx1.9M)	Kg	**103.58**		
40	Providing & fixing G.I chain-link mesh including fixing of post or struts, G.I staples (excluding the cost of posts/struts, earthwork, concrete etc.)-4 mm (8SWG)x50 mm.	Sqm	**345.87**		
	Drainage				
41	Constructing second class brick masonry open surface drain in cement mortar 1:4 including earth work in excavation 100 mm thick concrete bed 1:5:10, 40mm aggregate and 25mm thick cement concrete 1:2:4,12 mm aggregate for filling haunches including 12mm cement plastering 1:4 with a floating coat of neat cement and disposal of surplus earth etc. complete. - 300mm x 450mm depth	m	**226.00**		
	H.D.P.E pipes for Electrical Works				
42	Excavation in foundation trenches or drains not exceeding 1.5m in width or area 10 sq.m on plan, including dressing & ramming, disposal of surplus soil within all lead & lift. Ordinary soil. (for burying 40 or 50mm dia pipe)	Cum	**30.00**		
43	Filling of trenches, sides of foundations etc. in layers <200mm using selected excavated earth, ramming etc. within all lead and lifts. (for burying 40 or 50mm dia pipe)	Cum	**30.00**		
44	Providing &laying sand bedding, including watering, ramming, dressing	Cum	**7.50**		
45	Providing & laying H.D.P.E pipes, 12.5 PN, including H.D.P.E fittings (excluding trenching, refilling & thrust block) - 40mm	m	**200.00**		
46	Providing & laying H.D.P.E pipes, 12.5 PN, including H.D.P.E fittings (excluding trenching, refilling & thrust block) - 50mm	m	**50.00**		
	Foundation for LV Panel, 11kV Panel & Transformer				

47	Excavation in foundation trenches or drains not exceeding 1.5m in width or area 10 sq.m on plan, including dressing & ramming, disposal of surplus soil within all leads and lifts. Hard Soil	Cum	**3.90**		
48	Providing and laying Hand packed stone filling or soling with stones	Cum	**1.11**		
49	Providing and laying in position plain cement concrete excluding the cost of centering and shuttering - All work upto plinth level.1:2:4 (1 cement : 2 sand : 4 graded crushed rock 20 mm nominal size)	Cum	**0.43**		
50	Providing and laying in position plain cement concrete excluding the cost of centering and shuttering - All work upto plinth level. -1:3:6 (1 cement : 3 sand : 6 graded crushed rock 20 mm nominal size)	Cum	**0.56**		
51	Providing & laying Random Rubble Masonry with hard stone in foundation & plinth. In cement mortar 1:4	Cum	**4.04**		
52	Providing & fixing centering and shuttering (formwork), including strutting, propping etc. and removal of formwork- Foundation and plinth etc.	Sqm	**2.85**		
53	Providing and laying 20mm cement paster in cm 1:4	Sqm	**7.50**		
	Total Work (Nu.)				

Ng. (_____
_____)only

Signature & Seal of Bidder