

TENDER DOCUMENT
for
Renovation & Up-gradation of
Protection Systems of 132kV Sub-Stations
in Mizoram under
Power System Development Fund (PSDF)

Volume-I
Conditions of Contract

2016



ENGINEER-IN-CHIEF
POWER & ELECTRICITY DEPARTMENT
GOVT. OF MIZORAM

TENDER DOCUMENT
for
Renovation & Up-gradation of
Protection Systems of 132kV Sub-Stations
in Mizoram under
Power System Development Fund (PSDF)

Volume-II
Technical Specifications

2016



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TENDER DOCUMENT
for
Renovation & Up-gradation of
Protection Systems of 132kV Sub-Stations
in Mizoram under
Power System Development Fund (PSDF)

Volume-III
BID PROPOSAL SHEET

2016



ENGINEER-IN-CHIEF
POWER & ELECTRICITY DEPARTMENT
GOVT. OF MIZORAM

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Instructions to Tenderers

- 1.0 The Tenderers shall be required to submit the bids in two envelopes.
Envelope - 1 :- Technical bid.
Envelope - 2 :- Financial bid.
- 2.0 **Earnest Money** : The tenderers may submit bid for all groups or any group mentioned in the requirement using bid proposal sheet and shall have to furnish Earnest Money separately for each of the groups as below in the form of Bank Draft/Deposit at call from a nationalized bank pledged in favour of the Engineer-in-Chief, Power & Electricity Department in a separate covers super-scribing the Tender Specification, Item, Reference Number and Date of opening failing which the Tender will not be opened. Tribal Tenderers are allowed to submit Earnest Money for half the amount. Manufacturers registered with NSIC, DGS&D and also SSI unit under Government of Mizoram is exempted for payment of Earnest Money provided Registration Certificate is enclosed.

SUPPLY & ERECTION OF EQUIPMENTS :

Group	Items	Provisional Qty.	Earnest Money
I	132kV CB (3-Pole)	12	3,56,000.00
	33kV CB	13	
II	132kV CT (1-Ph)	51	2,18,000.00
	33kV CT (1-Ph)	54	
III	132kV Bus PT (1-Ph)	18	3,37,000.00
	33kV PT (1-Ph)	36	
	132kV line CVT (1-Ph)	51	
IV	132kV Surge Arrestor	63	74,000.00
	33kV Surge Arrestor	36	
V	132kV 3-Ph Isolator	7	66,000.00
	33kV 3-Ph Isolator	3	
VI	C&R Panel Line 132 kV	10	12,06,000.00
	C&R Panel Transformer 132 kV	8	
	C&R Panel Line 33 kV	9	
	C&R Panel Transformer 33 kV	7	
		TOTAL	22,57,000.00

- 3.0 **Validity** : Tender should be kept valid for a period of minimum 365 (three hundred sixty five) Calendar days from the date of opening of Tenders. Validity less than 365 (three hundred sixty five) days will be liable for rejection.
- 4.0 **Examination of the Documents** : The Contractor shall examine Conditions of Contract and Technical Specifications to satisfy himself about all the Terms & Conditions and circumstances affecting the Contract Price. He shall quote price(s) according to his own views on these matters and understand that no additional allowances except as otherwise provided therein will be levied. The Purchaser shall not be responsible for any misunderstanding or incorrect information obtained by the Contractor other than information given to the Contractor in writing by the Purchaser. The Tenderer shall give his/her signature with seal in each and every page of the Tender Document as an indication of his/her acceptance of the Terms and Conditions of the Tender.

In the Tender, no overwriting is allowed. Any corrections, if any, should be initialed and seal stamped by the Tenderer. Rates should be quoted both in figures and in words as far as practicable.

Non-Tribal Tenderers should submit the following along with their Tenders:

- 1) Sales Tax/VAT Clearance Certificate
- 2) Authorised Dealer must submit an Authorised Dealership Certificate issued by Manufacturers.
- 3) A copy of VAT Registration Certificate.
- 4) ISI/BIS Certificate.
- 5) Documents showing past experience.

Tribal Tenderers should submit the following along with their Tenders:

- 1) House Tax Payee Certificate
- 2) Sales Tax/VAT Clearance Certificate
- 3) Authorised Dealer must submit an Authorised Dealership Certificate issued by Manufacturers.
- 4) ISI/BIS Certificate.
- 5) A copy of VAT Registration Certificate.
- 6) Documents showing past experience.

- 5.0 **Patent Rights, etc** : The Contractor shall indemnify the Purchaser against all Claims, Actions, Suits and Proceedings for the infringement or alleged infringement of any patent design or copy right protected either in the Country of origin or in India by the use of any equipment supplied by the Contractor, but such indemnity shall not cover any use of equipment other than for the purpose indicated by or reasonably to be inferred from the specifications.
- 6.0 **Reservation** : The Purchaser reserves the right to accept or reject the bid partly or wholly without assigning any reason thereof. Further, the Owner is not bound to select the lowest Tenderer to execute the work. Tenderers who do not accept General Terms will be automatically rejected.
- 7.0 **Variations - Additions and Omission** :
- i) The Contractor shall not modify the materials and equipment except directed in writing by the Purchaser.
 - ii) The quantity stated in the tender is only provisional quantity. Purchaser/Employer shall have the right to alter, amend, omit or vary the equipment by notice in writing to the Contractor.
 - iii) If the Purchaser makes variations in any part of the materials/equipment, a reasonable notice shall be given in writing to the Contractor. In such cases where equipment has already been manufactured or is under manufacture, the Purchaser may consider payment of additional sum to the Contractor. If in the opinion of the Contractor such variation is likely to prevent or prejudice the Contractor from fulfilling any of his obligations under the contract, he shall notify the Purchaser thereof in writing and the Purchaser shall decide whether or not the variation shall be carried out.
- 8.0 **Contract shall be awarded in Group-wise.**

SECTION: 1
GENERAL CONDITIONS OF CONTRACT

GENERAL CONDITIONS OF CONTRACT

A. INTRODUCTION

1.0 DEFINITION OF TERMS

- 1.1 ~~The Contract~~ means the agreement entered into between Employer/Purchaser and Contractors as per the contract agreement signed by the parties, including all attachments and appendices thereto and all documents incorporated by reference therein.
- 1.2 ~~Owner~~ shall mean **Power & Electricity Department, Govt. of Mizoram** and shall include their legal representatives, successors and assigns.
- 1.3 ~~Contractor~~ shall mean the Firms / Joint Venture of two Firms to whom the Project execution work is awarded by **Power & Electricity Department, Govt. of Mizoram** and shall include such Firms / Joint Venture's legal representatives, successors and permitted assignees.
- 1.4 ~~Employer/Purchaser~~ shall mean the Engineer-in-Chief, Power & Electricity Department, Mizoram and shall include his legal representatives, successors and permitted assigns of such person.
- 1.5 ~~Engineer~~ shall mean the officer appointed in writing by the Employer/Purchaser to act as Engineer from time to time for the purpose of the Contract.
- 1.6 The terms ~~Equipment~~, ~~Stores~~ and ~~Materials~~ shall mean and include equipment, stores and materials to be provided by the contractor under the contract.
- 1.7 ~~Work~~ shall mean and include the furnishing of equipment, labour and services, as per the specifications and complete erection, testing and putting into satisfactory operation including all transportation, handling, unloading and storage at the Site as defined in the contract.
- 1.8 ~~Specifications~~ shall mean the specifications forming a part of the contract and such other schedules and drawings as may be mutually agreed upon.
- 1.9 ~~Site~~ shall mean and include the sub-station and other places on, into or through which the work and the related facilities are to be erected or installed and any adjacent land, paths, street or reservoir which may be allocated or used by the Employer/Purchaser or contractor in the performance of the contract.
- 1.10 The term **Price Components** shall mean i) Price of the equipments inclusive of all taxes, insurance and FOT destination ii) Erection Charges with cost of Insurance for erection, testing and putting into satisfactory operation.
- The term **Contract Price** shall mean the lump-sum firm price components with taxes and duties of the entire works awarded to the Contractor with additions and/or deletions as may be agreed and incorporated in the letter of award, for the entire scope of the work.
- 1.11 The term ~~Supply Portion~~ of the Contract price shall mean the value of the equipments inclusive of all taxes, insurance and FOT destination.

- 1.12 The term ~~Erection Portion~~ of the contract price shall mean the value of field activities of the work including erection, testing and putting into satisfactory operation including successful completion of performance and guarantee tests to be performed at site by the contractor including cost of insurances and all relevant taxes.
- 1.13 ~~Manufacturer's Works~~ or ~~Contractor's Works~~ shall mean the place of work used by the manufacturer, the contractor, their collaborators/associate for the performance of the contract.
- 1.14 ~~Inspector~~ shall mean the Employer/Purchaser or any person nominated by the Employer/Purchaser from time to time, to inspect the equipment; stores or works under the contract and/or the duly authorized representative of the Employer/Purchaser.
- 1.15 ~~Notification of Award of Contract/Letter of Award~~ shall mean the official notice issued by the Employer/Purchaser notifying the contractor that they are awarded the works.
- 1.16 ~~Date of Contract~~ shall mean the date on which notification of award of contract/letter of award/telex of award has been issued.
- 1.17 ~~Month~~ shall mean the calendar month. ~~Day~~ or ~~Days~~ unless herein otherwise expressly defined, shall mean calendar day or days of 24 hours each.
- 1.18 ~~Writing~~ shall include any manuscript, type written or printed statement, under or over signature and/or seal as the case may be.
- 1.19 When the words ~~Approved~~ ~~Subject to Approval~~ ~~Satisfactory~~ ~~Equal to~~ ~~Proper~~ ~~Requested~~ ~~As Directed~~ ~~Where Directed~~ ~~When Directed~~ ~~Determined by~~ ~~Accepted~~ ~~Permitted~~ or words and phrases of like importance are used, the approval, judgment, direction etc. is understood to be a function of the Employer/Purchaser/Engineer.
- 1.20 ~~Test on Completion~~ shall mean such tests as prescribed in the contract to be performed by the contractor before the work is taken over by the Employer/Purchaser.
- 1.21 ~~Start Up~~ shall mean the time period required to bring the equipment covered under the contract from an inactive condition, when construction is essentially complete, to the state ready for trial operation. The startup period shall include preliminary inspection and checkout of equipment and supporting sub-system, initial operation of the complete equipment covered under the contract to obtain necessary pre-trial operation data, perform calibration and corrective action, shut down, inspection and adjustment prior to the trial operation period.
- 1.22 ~~Initial Operation~~ shall mean the first integral operation of the complete equipment covered under the contract with the sub-system and supporting equipment in service or available for service.
- 1.23 ~~Trial Operation~~ ~~Reliability Test~~ ~~Trial Run~~ ~~Completion Test~~ shall mean the extended period of time after the start up period. During this trial operation period, the unit shall be operated over the full load range. The length of Trial Operation shall be as determined by the Engineer, unless otherwise specified elsewhere in the contract.
- 1.24 ~~Performance and Guarantee Test~~ shall mean all operational checks and tests required to determine and demonstrate capacity, efficiency and operating characteristics as specified in the contract documents.

- 1.25 The term **Final Acceptance/Taking Over** shall mean the Employer/Purchaser's written acceptance of the works performed under the contract, after successful commissioning/ completion of performance and guarantee tests, as specified in the accompanying technical specification or otherwise agreed in the contract.
- 1.26 **Commercial Operation** shall mean the conditions of operation in which the complete equipment covered under the contract is officially declared by the Employer/Purchaser to be available for continuous operation at different loads up to and including rated capacity. Such declaration by the Employer/Purchaser, however, shall not relieve or prejudice the contractor of any of his obligations under the contract.
- 1.27 **Warranty Period**, **Guarantee Period**, **Maintenance Period**, **Defect Liability Period** shall mean the period during which the contractor shall remain liable for repair or replacement of any defective part of the works performed under the contract.
- 1.28 **Latent Defects** shall mean such defects caused by faulty design, material or workmanship which cannot be detected during inspection, testing etc, based on the technology available for carrying out such tests.
- 1.29 **Drawing**, **Plans** shall mean all:
- a) Drawings submitted by the contractor with his bid provided such drawings are acceptable to the Employer/Purchaser
 - b) Drawings furnished by the Employer/Purchaser to the contractor during the progress of the work; and
 - c) As built drawings submitted by the contractor during the progress of the work provided such drawings are acceptable to the Employer/Purchaser
- 1.30 **Codes** shall mean the following including the latest amendments and / or replacement, if any:
- a) Electricity Act, 2003 and Rules & Regulations and amendments made there under.
 - b) The Factory Act, 1948 and Rules & Regulations and amendments made there under.
 - c) The Industrial Dispute Act, 1947 and rules & Regulations and amendments made there under.
 - d) Contract Labour (Regulation and Abolition) Act 1972 and rules & Regulations and amendments made there under and other Labour Laws applicable.
 - e) Indian Explosive Act, 1884 and Rules and Regulations and amendments made there under.
 - f) Indian Petroleum Act, 1934 and Rules & Regulations and amendments made there under.
 - g) A.S.M.E. Test Codes
 - h) A.I.E.E. Test Codes
 - i) American Society of Testing Material Codes.
 - j) Standards of the BIS.
 - k) Other Internationally approved standards and/or rules and Regulations touching the subject matter of the contract.

- 1.31 Words imparting the singular only shall also include the plural and vice-versa where the context so requires.
- 1.32 Words imparting ~~Person~~ shall include firms, companies, corporation and association or bodies of individuals, whether incorporated or not.
- 1.33 Terms and expressions not herein defined shall have the same meaning as are assigned to them in the Indian Sale of goods Act (1930), failing that in the Indian Contract Act (1872) and failing that in the General Clauses Act (1897) including amendments thereof if any.
- 1.34 In addition to the above the following definitions shall also apply.
- a) ~~All equipment and materials~~ to be supplied shall also mean ~~Goods~~
 - b) ~~Constructed~~ shall also mean ~~erected and installed~~
 - c) ~~Contract Performance Guarantee~~ shall also mean ~~Contract Performance Security~~
 - d) ~~Zero Date~~ will be started from the date of acceptance of ~~Letter of Award~~ by the successful bidder.

2.0 APPLICATION

These General Conditions shall apply to the extent that they are not superseded by provisions in other parts of the contract.

3.0 STANDARDS

The Goods supplied under this contract shall conform to the standards mentioned in the Various Technical Specifications and when no applicable standard is mentioned, to the authoritative standard appropriate to the Goods and such standards shall be the latest issued by the concerned institution.

4.0 LANGUAGE AND MEASURES

All documents pertaining to the contract including specification, schedules, notices, correspondence, operating and maintenance instruction, drawings or any other writing shall be written in English language. The Metric System of measurement shall be used exclusively in the contract.

5.0 CONTRACT DOCUMENTS

- 5.1 The term ~~Contract Documents~~ shall mean and include the following, which shall be deemed to form an integral part of the contract:
- a) General terms and conditions of contract, General Technical Condition, Erection conditions of contract and all other documents included under and the special conditions of contract and various other sections.
 - b) Specifications of the equipment to be furnished and erected under the contract as brought out in the accompanying technical specification.
 - c) All the materials, literature, data and information of any sort given by the contractor subject to the approval of the owner/ consultant.
 - d) Letter of award and any agreed variations of the conditions of the documents and special terms and conditions of contract if any.

- 5.2 In the event of any conflict between the above-mentioned documents, the matter shall be referred to the Employer/Purchaser whose decision shall be considered as final and binding upon the parties.

6.0 USE THE CONTRACT DOCUMENTS AND INFORMATION

- 6.1 The contractor shall not, without the owner's prior written consent, disclose the contract, or any provision thereof, or any specification, plan, drawing, pattern, sample or information furnished by or on behalf of the owner in connection therewith, to any person other than a person employed by the contractor in the performance of the contract. Disclosure to any such employed person shall be made in confidence and shall extend only so far as may be necessary for purposes of such performance.
- 6.2 The contractor shall not, without the Employer/Purchaser's prior written consent, make use of any document or information enumerated in various contract documents except for purpose of performing the contract.
- 6.3 The contractor shall not communicate or use in advertising, publicity, sales releases or in any other medium, photographs or other reproduction of the works under this contract, or descriptions of the site, dimensions, quantity, quality, or other information, concerning the works unless prior written permission has been obtained from the Employer/Purchaser.
- 6.4 Any document, other than the contract itself, enumerated in various contract documents shall remain the property of the owner and shall be returned (in all copies) to the Employer/Purchaser on completion of the contractor's performance under the contract, if so required by the Employer/Purchaser.

7.0 CONSTRUCTION OF THE CONTRACT

- 7.1 Award of Contract shall be placed in equipment-wise by the Employer/Purchaser to the selected contractors.. The contract shall includes supply of equipments at site and installation, testing & commissioning.
- 7.2 The Contractor shall supply and deliver the materials / equipments to the designated Consignees at the designated work sites and erection work shall be commenced as per the instruction of the Employer/Purchaser. The list of designated Consignees, Paying Authorities and the designated work sites shall be given in the Letter of Award.
- 7.3 The contract shall in all respects be construed and governed according to Indian Laws.

8.0 JURISDICTION OF CONTRACT

- 8.1 The laws applicable to the contract shall be the laws in force in India. The courts of **Mizoram** only shall have exclusive jurisdiction in all matters arising under this contract.

9.0 MANNER OF EXECUTION OF CONTRACT

- 9.1 The Employer/Purchaser, after the issue of the letter of award to the contractor, will send one copy of the final agreement to the contractor for his scrutiny and approval.
- 9.2 The Contract Agreement, unless otherwise agreed to, shall be signed within 90 days of the acknowledgement of the letter of award, at the office of the Engineer-in-Chief on a date and time to be mutually agreed. The contractor shall provide for signing of the contract, performance guarantee, appropriate power of attorney and other requisite materials. In case

the contract is to be signed beyond the stipulated time, the guarantee made by the Contractor will have to be extended accordingly.

- 9.3 The agreement will be signed on Non Judicial Stamp Paper (NJS) and in 2 (Two) original copies and the contractor shall be provided with one signed original and the other one will be retained by the Employer/Purchaser.
- 9.4 The contractor shall provide free of cost to the Employer/Purchaser all the basic drawings and descriptive materials for approval of the Engineer-in-Chief in at least two (2) copies with soft copy in pdf/dwg format wherever required to form a part of the contract.

10.0 ENFORCEMENT OF TERMS

- 10.1 The failure of either party to enforce at any time any of the provisions of this contract or any rights in respect thereto or to exercise any option therein provided, shall in no way be construed to be a waiver of such provisions, rights or options or in any way to affect the validity of the contract. The exercise by either of any of its rights herein shall not preclude or prejudice either party from exercising the same or any other right it may have under the contract.

11.0 COMPLETION OF CONTRACT

- 11.1 Unless otherwise terminated under the provisions of any other relevant clause, this contract shall be deemed to have been completed on the expiry of the guarantee period as provided for under the clause entitled "Guarantee" in this section of specification.

B. GUARANTEE & LIABILITIES

12.0 TIME – THE ESSENCE OF CONTRACT

- 12.1 The time and date of completion of the contract as stipulated in the contract by the Employer/Purchaser without or with modifications, if any, and so incorporated in the letter of award, shall be deemed to be the essence of the contract. The contractor shall so organize his resources and perform his work as to complete it not later than the date agreed to.
- 12.2 The contractor shall submit a detailed PERT Network/Bar Chart within the time frame agreed consisting of adequate number of activities covering various key phases of the work such as design, procurement, manufacturing, shipment and field erection activities within Ninety (90) days of the date of Notice of Award of Contract. This network shall also indicate the interface facilities to be provided by the Employer/Purchaser and the dates by which such facilities are needed. The contractor shall discuss the Network so submitted with the Employer/Purchaser and the agreed Network shall form part of the contract documents. As provided in the clause of terms of payment in this section, finalization of the Network/Bar Charts will be pre-conditions to release of any initial advance to the contractor. During the performance of the contract, if in the opinion of the Engineer, proper progress is not maintained, suitable changes shall be made in the contractor's operations to ensure proper progress without any cost implication to the owner. The interface facilities to be provided by the owner in accordance with the agreed Network shall also be reviewed while reviewing the progress of the contractor.
- 12.3 Based on the agreed PERT Network/Bar Chart monthly reports shall be submitted by the contractor as directed by the Engineer.

- 12.4 Subsequent to the finalization of the PERT Network/BAR Chart, the contractor shall make available to the Engineer a detailed manufacturing programme in line with the agreed contract Network. Such manufacturing programme shall be reviewed, updated and submitted to the Engineer once in every two months thereafter.
- 12.5 The above PERT Network/Bar Charts/Manufacturing programme shall be compatible with the Employer/Purchaser's computer environment and furnished on such media as may be desired by the Employer/Purchaser.

13.0 EFFECTIVENESS OF CONTRACT

The contract shall be considered as having come into force from the date of the notification of award, unless otherwise provided in the notification of award.

14.0 LIQUIDATED DAMAGES

- 14.1 If the contractor fails to successfully complete commissioning within the scheduled time fixed under the contract, the contractor shall pay to the Employer/Purchaser as liquidated damages and not as penalty, a sum specified for each specified period of delays. The details of such liquidated damages are brought out in the accompanying Special Conditions of Contract (SCC).
- 14.2 Equipment and materials will be deemed to have been delivered only when all its components, parts are also delivered. If certain components are not delivered in time, the equipment and materials will be considered as delayed until such time the missing parts are also delivered.
- 14.3 The total amount of Liquidated Damages (LD) for delay under the contract will be @ ½% (half percent) of the contract value of the material supplied beyond scheduled date, per month or part thereof. However, the value of LD shall be limited to a maximum of 5% of the total material price not supplied within scheduled completion date as per LOA/ Contract.

15.0 GUARANTEE

- 15.1 The contractor shall warrant that the equipment will be new, unused and in accordance with the contract documents and free from defects in material and workmanship for a period of twelve (12) calendar months from the date of commissioning. The contractor's liability shall be limited to the replacement of any defective parts in the equipment of his own manufacture under normal use and arising solely from faulty design, materials and/or workmanship provided always that such defective parts are repairable at the site and are not in meantime essential in the commercial use of the equipment. Such replaced/defective parts shall be returned to the contractor unless otherwise arranged. No repairs or replacement shall normally be carried out by the Engineer when the equipment is under the supervision of the contractor's supervisory Engineer.
- 15.2 In the event of any emergency, where in the judgment of the engineer, delay would cause serious loss or damages, repairs or adjustment may be made by the engineer or a third party chosen by the engineer without advance notice to the contractor and the cost of such work shall be paid by the contractor. In the event such action is taken by the engineer, the contractor will be notified promptly and he shall assist wherever possible in making necessary corrections. This shall not relieve the contractor of his liabilities under the terms and conditions of the contract.

- 15.3 If it becomes necessary for the contractor to replace or renew any defective portions of the works, the provision of this clause shall apply to portion of the works so replaced or renewed until the expiry of twelve (12) months from the date of such replacement or renewal. If any defects are not remedied within a reasonable time, the engineer may proceed to do the work at the contractor's risk and cost, but without prejudice to any other rights, which the owner may have against the contractor in respect of such defects.
- 15.4 The repaired or new parts will be furnished and erected free of cost by the contractor. If any repair is carried out on his behalf at the site, the contractor shall bear the cost of such repairs.
- 15.5 The cost of any special or general overhaul rendered necessary during the maintenance period due to defects in the equipment or defective work carried out by the contractor, the same shall be borne by the contractor.
- 15.6 The acceptance of the equipment by the engineer shall in no way relieve the contractor of his obligation under this clause.
- 15.7 In the case of those defective parts, which are not repairable at site but are essential for the commercial operation of the equipment, the contractor and the engineer shall mutually agree to a programme of replacement or renewal, which will minimize interruption to the maximum extent in the operation of the equipment.
- 15.8 At the end of the guarantee period, the contractor's liability ceases except for latent defects. For latent defects, the contractor's liability as mentioned in clause nos. 15.1 through 15.7 above, shall remain till the end of 5 years from the date of completion of guarantee period.
- 15.9 The provisions contained in this clause will not be applicable:
- a) If the owner has not used the equipment according to generally approved industrial practice and in accordance with the conditions of operations specified and in accordance with operating manuals, if any.
 - b) In cases of normal wear and tear of the parts to be specifically mentioned by the contractor in the offer.

16.0 TAXES, PERMITS & LICENCES

The contractor shall be liable and pay all non-Indian taxes, duties, levies lawfully assessed against the owner or the contractor in pursuance of the contract. In addition, the contractor shall be responsible for payment of all Indian duties, levies and taxes lawfully assessed against the contractor for his personal income & property only.

17.0 REPLACEMENT OF DEFECTIVE PARTS AND MATERIALS

- 17.1 If during the performance of the contract, the engineer shall decide and inform in writing to the contractor that the contractor has manufactured any equipment, material or part of equipment unsound and imperfect or has furnished any equipment inferior to the quality specified, the contractor on receiving details of such defects or deficiencies shall at his own expense within seven (7) days of his receiving the notice, or otherwise, within such time as may be reasonably necessary for making it good, proceed to alter, reconstruct or remove such works and furnish fresh equipment/materials up to the standards of the specifications. In case, the contractor fails to do so, the engineer may on giving the contractor seven (7) days notice in writing of his intentions to do so, proceed to remove the portion of the works so complained of and at the cost of the contractor perform all such work or furnish all such

equipment / materials provided that nothing in this clause shall be deemed to deprive the owner of or affect any rights under the contract which the owner may otherwise have in respect of such defects and deficiencies.

- 17.2 The Contractors cannot claim any extra payment for replacement of any defective equipment/materials after commissioning during guarantee period. They are fully liable to replace these to their own cost.

18.0 PATENT RIGHTS AND ROYALTIES

Royalties and fees for patents covering materials, articles, apparatus, devices, equipment or processes used in the works shall be deemed to have been included in the contract price. The contractor shall satisfy all demands that may be made at any time for such royalties or fees and he alone shall be liable for any damages or claims for patent infringements and shall keep the owner indemnified in that regard. The contractor shall, at his own cost and expense, defend all suits or proceedings that may be instituted for alleged infringement of any patents involved in the works, and, in case of an award of damages, the contractor shall pay for such award. In the event of any suit or other proceedings instituted against the owner, the same shall be defended at the cost and expense of the contractor who shall also satisfy/comply with any decree, order or award made against the owner. But it shall be understood that no such machine, plant, work, material or thing have been used by the owner for any purpose or any manner other than that for which they have been furnished and installed by the contractor and specified under these specifications. Final payment to the contractor by the owner will not be made while any such suit or claim remains unsettled. In the event any apparatus or equipment, or any part thereof furnished by the contractor, is in such suit or proceedings held to constitute infringement, and its use is enjoined, the contractor shall at his option and at his own expense, either procure for the owner, the right to continue the use of said apparatus, equipment or part thereof, replace it with non-infringing apparatus or equipment or modify it, so it becomes non-infringing.

19.0 DEFENCE OF SUITS

If any action in court is brought against the owner or engineer or an officer or agent of the owner, for the failure, omission or neglect on the part of the contractor to perform any acts, matters, covenants or things under the contract, or for damage or injury caused by the alleged omission or negligence on the part of the contractor, his agents, representatives or in connection with any claim based on lawful demands of workmen, suppliers or employees, the contractor shall in all such cases indemnify and keep the owner, and the engineer and/or his representative, harmless from all losses, damages, expenses or decrees arising of such action.

20.0 LIMITATION OF LIABILITIES

The final payment by the owner in pursuance of the contract shall mean the release of the contractor from all his liabilities under the contract. Such final payment shall be made only at the end of the Guarantee/Warranty Period, and till such time as the contractual liabilities and responsibilities of the contractor, shall prevail. All other payments made under the contract shall be treated as on-account payments.

21.0 ENGINEER'S DECISION

- 21.1 In respect of all matters which are left to the decision of the engineer including the granting or withholding of the certificates, the engineer shall, if required to do so by the contractor, give in writing a decision thereon.

- 21.2 If, in the opinion of the contractor, a decision made by the engineer is not in accordance with the meaning and intent of the contract, the contractor may file with the engineer, within fifteen (15) days after receipt of the decision, a written objection to the decision. Failure to file an objection within the allotted time will be considered as an acceptance of the engineer's decision and the decision shall become final and binding.
- 21.3 The Engineer's decision and the filing of the written objection thereto shall be a condition precedent to the right to request arbitration. It is the intent of the agreement that there shall be no delay in the execution of the works and the decision of the engineer as rendered shall be promptly observed.

22.0 POWER TO VARY OR OMIT WORK

- 22.1 No alteration, amendments, omissions, suspensions or variations of the works (hereinafter referred to as "variation") under the contract as detailed in the contract document, shall be made by the contractor except as directed in writing by the Engineer, but the Engineer shall have full powers subject to the provisions hereinafter contained, from time to time during the execution of the contract, by notice in writing to instruct the contractor to make such variation without prejudice to the contract. The contractor should carry out such variation and be bound by the same conditions as far as applicable as though the said variations occurred in the contract documents. If any suggested variations would, in the opinion of the contractor, if carried out, prevent him from fulfilling any of his obligations or guarantees under the contract, he shall notify the engineer thereof in writing and the engineer shall decide forthwith whether or not, the same shall be carried out and if the engineer confirm his instructions, the contractor's obligations and guarantees shall be modified to such an extent as may be mutually agreed. Any agreed difference in cost occasioned by any such variation shall be added to or deducted from the contract price as the case may be.
- 22.2 In the event of engineer requiring any variation, a reasonable and proper notice shall be given to the contractor to enable him to work his arrangement accordingly, and in cases where goods or materials are already prepared or any design, drawings or pattern made or work done requires to be altered, a reasonable and agreed sum in respect thereof shall be paid to the contractor.
- 22.3 In any case in which the contractor has received instructions from the engineer as to the requirement of carrying out the alterations or additional or substituted work which either then or later on, will in the opinion of the contractor, involve a claim for additional payment, the contractor shall immediately and in no case later than thirty (30) days, after receipt of the instructions aforesaid and before carrying out the instructions, advise the engineer to that effect. But the engineer shall not become liable for the payment of any charges in respect of any such variations, unless the instructions for the performance of the same shall be confirmed in writing by the engineer.
- 22.4 In all the above cases, in the event of a disagreement as to the reasonableness of the said sum, the decision of the Engineer shall prevail.
- 22.5 Notwithstanding anything stated above in this clause, the Engineer shall have the full power to instruct the contractor, in writing, during the execution of the contract to vary the quantities of the items or groups of items in accordance with the provisions of clause entitled "change of Quantity" in clause 24.0 of this section. The contractor shall carry out such variations and be bound by the same conditions as though the said variations occurred in the contract documents. However, the contract price shall be adjusted at the rates and the prices provided for the original quantities in the contract.

23.0 ASSIGNMENT AND SUB-LETTING OF CONTRACT

23.1 No Subletting/Sub-Contract is allowed.

24.0 CHANGE OF QUANTITY

24.1 During the execution of the contract, the Purchaser/Employer reserves the right to increase or decrease the quantities of items under the Contract but without any change in unit price or other terms and conditions. Such variations unless otherwise specified in the accompanying Special Conditions of Contract and / or Technical Specification, shall not be subjected to any limitation for the individual items but the total variations in all such items under the Contract shall be limited to a percentage of the Contract price as specified in the Special Conditions of Contract.

24.2 The Contract price shall accordingly be adjusted based on the unit rates available in the Contract for the change in quantities as above. The base unit rates, as identified in the Contract shall however remain constant during the currency of the Contract, except as provided for in clause 33.0 below. In case, the unit rates are not available for the change in quantity, the same shall be subjected to analysis of rates to be approved by the Engineer in charge.

25.0 PACKING, FORWARDING AND SHIPMENT

25.1 The Contractor, wherever applicable, shall after proper painting, pack and crate all equipment in such a manner as to protect them from deterioration and damage during rail and road transportation to the site and storage at the site till the time of erection. The contractor shall be held responsible for all damages due to improper package.

25.2 The Contractor shall notify the Purchaser/Employer of the date of each shipment from his works, and the expected date of arrival at the site for the information of the Purchaser/Employer.

25.3 The Contractor shall also give all shipping information concerning the weight, size and content of each packing including any other information the Purchaser/Employer may require.

25.4 The Contractor shall prepare detailed packing list of all packages and containers, bundles and loose materials forming each and every consignment dispatch to site.

The Contractor shall further be responsible for making all necessary arrangements for loading, unloading and other handling, right from his works up to the Site and also till equipment is erected, tested and commissioned. He shall be solely responsible for proper storage and safe custody of all equipment.

26.0 COOPERATION WITH OTHER CONTRACTORS AND CONSULTING ENGINEERS

The Contractor shall agree to cooperate with the Owner's other Contractors and Consulting Engineers and freely exchange with them such technical information, as is necessary to obtain the most efficient and economical design and to avoid unnecessary duplication of efforts. The Engineer shall be provided with three copies of all correspondence addressed by the Contractor to the other Contractors and consulting Engineers of the Owner in respect of such exchange of technical information.

27.0 NO WAIVER OF RIGHTS

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

28.0 CERTIFICATE NOT TO AFFECT RIGHT OF OWNER AND LIABILITY OF CONTRACTOR

No interim payment certificate of the Engineer, nor any sum paid on account by the Purchaser/Employer, nor any extension of time for execution of the works granted by the Engineer shall affect or prejudice the rights of the Purchaser/Employer against the Contractor or relieve the Contractor of his obligation for the due performance of the Contractor, or be interpreted as approval of the Works done or of the equipment furnished and no certificate shall create liability for the Purchaser/Employer to pay for alternations, amendments, variations or additional works not ordered, in writing, by the Engineer or discharge the liability of the contractor for the payment of damages whether due, ascertained or certified or not or any sum against the payment of which he is bound to indemnify the Purchaser/Employer, nor shall any such certificate nor the acceptance by him of any sum paid on account or otherwise affect or prejudice the rights of Purchaser/Employer against the Contractor.

29.0 PROGRESS REPORTS

During the various stages of the Work in the pursuance of the Contract, the Contractor shall at his own cost submit periodic progress reports as may be reasonably required by the Engineer with such materials as, charts, net-works, photographs, test certificates, etc. Such progress reports shall be in the form and size may be required by the Engineer and shall be submitted in at least three (3) copies.

30.0 TAKING OVER

Upon successful completion of all the tests to be performed at Site on equipment furnished and erected by the Contractor, the Engineer shall issue to the Contractor a Taking over Certificate as a proof of the final acceptance of the equipment. Such certificate shall not unreasonably be withheld nor will the engineer delay the issuance thereof on account of minor omissions or defects, which do not affect the commercial operation and/or cause any serious risk to the equipment. Such certificate shall not relieve the Contractor of any of his obligations which otherwise survive, by the terms and conditions of the Contract after issue of such certificate.

C. CONTRACT SECURITY AND PAYMENTS

31.0 CONTRACT PERFORMANCE GUARANTEE

The Contractor shall furnish contract performance guarantee(s) for the proper fulfillment of the Contract in the prescribed form within hundred (100) days of Letter of Award of Contract. The performance guarantee (s) shall be as per terms prescribed in Clause 6.0 of Special Conditions of Contract.

32.0 CONTRACT PRICE REVISION

All the prices/ price components of the contract shall remain firm and no adjustment of price shall be applicable during the period of contract.

33.0 PAYMENT

33.1 The payment to the Contractor for the performance of the Works under the Contract will be made by the Purchaser/Employer as per the guidelines and conditions specified herein. All payment made during the contract shall be on account payments only. The final payment will be made on completion of all Works and on fulfillment by the Contractor of all his liabilities under the contract.

33.2 Currency of Payment

All payments under the Contract shall be in Indian Rupees only.

33.3 Due Dates for Payments

The initial advance amount shall be payable after fulfillment of all the conditions laid down in the Special Conditions of Contract, Clause 33.7.1 below and receipt of the contractor's invoice along with all necessary supporting documents for such advance payment. The price component of the initial advance amount will become due for payment within sixty (60) days of receipt of the Contractor's invoice. The Purchaser/Employer shall make progressive payment as and when the payment is due as per the terms of payment set forth in the accompanying Special Conditions of Contract.

33.4 Payment Schedule

The Contractor shall prepare and submit to the Purchaser/Employer for approval, a break-up of the Contract Price. This Contract Price break-up shall be interlinked with the agreed detailed PERT/BAR Chart network of the Contractor setting forth his starting and completion dates for the various key phases of Works prepared as per conditions in Clause 12.0 of this Section GCC. **Any payment under the Contract shall be made only after the Contractor's price break-up is approved by the Purchaser.** The aggregate sum of the Contractor's price break-up shall be equal to the lump sum contract Price. A Price Break-up over valuing those items of supply, which will be shipped first will not be accepted.

33.5 Application for Payment

33.5.1 The Contractor shall submit Application for the Payment in the prescribed proforma of the Purchaser/Employer. Proforma for application for payment is enclosed in forms of bid (Section-4).

33.5.2 Each such application shall state the amount claimed and shall set forth in detail, in the order of the Payment Schedule, particulars of the Works including the Works executed at Site and of the equipment shipped/brought on to the site pursuant to the Contract up to the date mentioned in the application and for the period covered since the last preceding certificate, if any.

33.5.3 Every interim payment certificate shall certify the contract value of the Works executed up to the date mentioned in the application for the payment certificate, provided that no sum shall be included in any interim payment certificate in respect of the works that, according to the decision of the Engineer, does not comply with the contract, or has been performed, at the date of certificate prematurely.

33.6 Mode of Payment

33.6.1 Payment due on dispatch of Equipment shall be made by the Purchaser/Employer's Bank or directly to the Contractor as per the payment schedule.

33.6.2 The payment of the advance mobilization, progressive payment, price adjustment if any, final payment and the erection portion of the Works shall be made direct to the contractor by the Purchaser/Employer.

33.7 TERMS OF PAYMENT

33.7.1 Price of Equipment and Erection

The terms of payments for the price-components of the equipment and erection are detailed in Special Conditions of Contract, for each equipment package. A certain percentage of the Supply Contract for each of the equipment shall be paid as initial mobilization advance on fulfillment of the following by the Contractor:

For Supply of materials and Erection :

- a) Acceptance of Letter of Award by the Contractor.
- b) Contractor's detailed Invoice.
- c) An unconditional & irrevocable Bank Guarantee for the equivalent amount covering the advance amount which shall initially be kept valid up to the contract period. This shall be kept renewed time to time to cover the balance amount and likely period to complete recovery together with interest.
- d) An unconditional & irrevocable Bank Guarantee for Five percent (5%) of the total Contract Price towards Contract Performance Guarantee (CPG) which shall initially be kept valid up to ninety (90) days after the expiry of Warranty/Guarantee Period of the Equipment as per Clause No. 15.0 of GCC, and shall be extended from time to time till ninety (90) days beyond successful completion of Warranty/Guarantee Period, as maybe required under the Contract.
- e) Detailed PERT Network/Bar Chart and its approval by the Purchaser/Employer.

33.7.2 All further payments under the contract shall be made as stipulated in the Special Conditions of Contract after signing the Contract Agreement.

33.7.3 Inland Transportation & Insurance

Inland transportation and inland insurance charges shall be included in the contract price.

34.0 DEDUCTION FROM CONTRACT PRICE

All costs, damages or expenses which the Purchaser/Employer may have paid, for which under the Contract, the contractor is liable, will be claimed by the Purchaser/Employer. All such claims shall be billed by the Purchaser/Employer to the Contractor regularly as and when they fall due. Such bills shall be supported by appropriate and certified vouchers or explanations, to enable the contractor to properly identify such claims. Such claims shall be paid by the Contractor within thirty (30) days of the receipt of the corresponding bills and if not paid by the Contractor within the said period, the Purchaser/Employer may then deduct the amount, from any amount due or becoming due by him to the contractor under the Contract or may be recovered by sections of Law or otherwise.

D. SPARES

35.0 SPARES

Spares are not included in the scope of work.

E. RISK DISTRIBUTION

36.0 TRANSFER OF THE TITLE

- 36.1 Transfer of the title in respect of equipment and materials supplied by the contractor to Power & Electricity Department, Mizoram pursuant to the terms of the contract shall pass on to Power & Electricity Department, Mizoram with ex-works dispatch and negotiation of dispatch documents.
- 36.2 This Transfer of Title shall not be construed to mean the acceptance and the consequent Taking Over of equipment and materials. The contractor shall continue to be responsible for the quality and performance of such equipment and materials and for their compliance with the specifications until Taking Over and the fulfillment of guarantee provisions of this Contract.
- 36.3 This Transfer of Title shall not relieve the Contractor from the responsibility for all risks of loss or damage to the equipment and materials as specified under the clause entitled Insurance of this Section.

37.0 INSURANCE

- 37.1 The Contractor at his cost shall arrange, secure and maintain all insurance as may be pertinent to the Works and obligatory in terms of law to protect his interest and interests of the Purchaser/Employer against all perils detailed herein. The form and the limit of such insurance as defined herein together with the under-writer in each case shall be acceptable to the Purchaser/Employer. However, irrespective of such acceptance, the responsibility to maintain adequate insurance coverage at all time during the period of contract shall be of the contractor alone. The contractor's failure in this regard shall not relieve him of any of his contractual responsibilities and obligations. The insurance covers to be taken by the contractor shall be in a joint name of the Purchaser/Employer and the Contractor. The Contractor shall, however, be authorized to deal directly with Insurance Company or companies and shall be responsible in regard to maintenance of all insurance covers. Further, the insurance should be in freely convertible currency.
- 37.2 Any loss or damage to the equipment during handling, transportation, storage, erection, putting into satisfactory operation and all activities to be performed till the successful completion of commissioning of the equipment shall be to the account of Contractor. The Contractor shall be responsible for preference of all claims and make good the damages or loss by way of repairs and/or replacement of the equipment, damaged or lost. The transfer of title shall not in any way relieve the Contractor of the above responsibilities during the period of Contract. The contractor shall provide the Purchaser/Employer with copy of all insurance policies and documents taken out by him in pursuance of the contract. Such copies of documents shall be submitted to the Purchaser/Employer immediately after such insurance coverage. The Contractor shall also inform the Purchaser/Employer in writing at least sixty (60) days in advance regarding the expiry/cancellation and/or change in any of such documents and ensure revalidation, renewal, etc., as may be necessary well in time.
- 37.3 The perils required to be covered under the insurance shall include, but not be limited to fire and allied risks, miscellaneous accidents (erection risks) workman compensation risks, loss or damage in transit, theft, pilferage riot and strikes and malicious damages, civil commotion, weather condition, accidents of all kinds, etc. The scope of such insurance shall be adequate to cover the replacement/reinstatement cost of the equipment for all risks up to and including delivery of goods and other costs till the equipment is delivered at Site. The insurance policies to be taken should be on replacement value basis and/or incorporating escalation clause.

Notwithstanding the extent of insurance cover and the amount of claim available from the underwriters, the contractor shall be liable to make good the full replacement/rectification value of all equipments/materials and to ensure their availability as per project requirements.

- 37.4 All costs on account of insurance liabilities covered under the contract will be to Contractor's account and will be included in Contract Price. However, the Purchaser/Employer may from time to time, during the pendency of the contract, may ask the contractor in writing to limit the insurance coverage, risks and in such a case, the parties to the contract will agree for a mutual settlement, for reduction in Contract price to the extent of reduced premium amount. The Contractor, while arranging the insurance shall ensure to obtain all discounts on premium which may be available for higher volume or for reason of financing arrangement of the project.
- 37.5 The clause entitled 'Insurance' under the Section ECC (section-3), covers the additional insurance requirements for the portion of the works to be performed at the Site.

38.0 LIABILITY FOR ACCIDENTS AND DAMAGES

Under the Contract, the Contractor shall be responsible for loss or damage to the plant until the successful completion of commissioning as defined elsewhere in the Bidding Documents.

39.0 DELAYS BY PURCHASER/EMPLOYER OR HIS AUTHORISED AGENTS

- 39.1 In case the Contractor's performance is delayed due to any act of omission on the part of the Purchaser/Employer or his authorized agents, then the Contractor shall be given due extension of time for the completion of the Works, to the extent of such omission on the part of the Purchaser/Employer has caused delay in the Contractor's performance of the Contract.

Regarding reasonableness or otherwise of the extension of time, the decision of the Engineer shall be final,

- 39.2 In addition, the Contractor shall be entitled to claim demonstrable and reasonable compensation if such delays have resulted in any increase in cost. The Purchaser/Employer shall examine the justification for such a request for claim and if satisfied, the extent of compensation shall be mutually agreed depending upon the circumstances at the time of such an occurrence.
- 40.0 DEMURRAGE, WHARFAGE, ETC.**
All demurrage, wharfage and other expenses incurred due to delayed clearance of the material or any other reason shall be to the account of the Contractor.

F. FORCE MAJEURE

41.0 FORCE MAJEURE

- 41.1 Force majeure is herein defined as any cause which is beyond the control of the contractor or the Purchaser/Employer as the case may be, which they could not foresee or with a reasonable amount of diligence could not have foreseen and which substantially affects the performance of the Contract, such as:
- a) Natural phenomena, including but not limit to floods, droughts, earthquakes and epidemics;
 - b) Acts of any Government, domestic or foreign, including but not limited to war, declared or undeclared, priorities, quarantines, embargoes.

Provided either party shall within fifteen (15) days from the occurrence of such a cause notify the other in writing of such causes.

- 41.2 The Contractor or the Purchaser/Employer shall not be liable for delays in performing his obligations resulting from any force-majeure cause as referred to and/or defined above.

The date of completion will, subject to hereinafter provided, be extended by a reasonable time even though such cause may occur after contractor's performance of obligation has been delayed to other causes.

42.0 SUSPENSION OF WORK

- 42.1 The Purchaser/Employer reserve the right to suspend and reinstate execution of the whole or any part of the Works without invalidating the provisions of the Contract. Orders for suspension or reinstatement of the Works will be issued by the Engineer to the Contractor in writing. The time for completion of the works will be extended for a period equal to the duration of the suspension.

- 42.2 Any necessary and demonstrable cost incurred by the Contractor as a result of such suspension of the Works will be paid by the Purchaser/Employer, provided such costs are substantiated to the satisfaction of the Engineer. The Purchaser/Employer shall not be responsible for any liabilities, if suspension or delay is due to some default on the part of the Contractor.

43.0 CONTRACTOR'S DEFAULT

- 43.1 If the Contractor shall neglect to execute the Works with due diligence and expertise or shall refuse or neglect to comply with any reasonable order given to him, in the Contract by the Engineer in connection with the works or shall contravene the provisions of the Contract, the Purchaser/Employer may give notice in writing to the contractor to make good the failure, neglect or contravention complained of. Should the contractor fail to comply with the notice within thirty (30) days from the date of serving the notice, then and in such case the Purchaser/Employer shall be at liberty to employ other workmen and forthwith execute such part of the works as the Contractor, may have neglected to do or if the Purchaser/Employer shall think fit, without prejudice to any other right he may have under the Contract to take the work wholly or in part out of the contractor's hands and re-contract with any other person or persons to complete the works or any part thereof and in that event the Purchaser/Employer shall have free use of all Contractor's equipment that may have been at the time on the site in connection with the works without being responsible to the Contractor for fair wear and tear thereof and to the exclusion of any right of the contractor over the same, and the Purchaser/Employer shall be entitled to retain and apply any balance which may otherwise be due on the Contract by him to the contractor, or such part thereof as may be necessary, to the payment of the cost of executing the said part of the work or of completing the Works as the case may be. If the cost of completing of Works or executing a part thereof as aforesaid shall exceed the balance due to the contractor, the contractor shall pay such excess. Such payment of excess amount shall be independent of the liquidated damages for delay which the contractor shall have to pay if the completion of works is delayed.
- 43.2 In addition, such action by the Purchaser/Employer as aforesaid shall not relieve the Contractor of his liability to pay liquidated damages for delay in completion of works as defined in clause 14.0 of this Section.

Such action by the Purchaser/Employer as aforesaid, the termination of the Contract under this clause shall neither entitle the contractor to reduce the value of the contract Performance

Guarantee nor the time thereof. The contract Performance Guarantee shall be valid for the full value and for the full period of the contract including guarantee period.

44.0 TERMINATION OF CONTRACT ON PURCHASER/EMPLOYER'S INITIATIVE

- 44.1 The Purchaser/Employer reserves the right to terminate the Contract either in part or in full due to reasons other than those mentioned under clause entitled "Contractor's Default." The Purchaser/Employer shall in such an event give fifteen (15) days notice in writing to the Contractor of his decision to do so.
- 44.2 The Contractor upon receipt of such notice shall discontinue the work on the date and to the extent specified in the notice, make all reasonable efforts to obtain cancellation of all orders and contracts to the extent they are related to the work terminated and terms satisfactory to the Purchaser/Employer, stop all further purchasing activity related to the work terminated, and assist the Purchaser/Employer in maintenance, protection, and disposition of the Works acquired under the Contract by the Purchaser/Employer.
- 44.3 In the event of such a termination, the Contractor shall be paid compensation, equitable and reasonable, dictated by the circumstances prevalent at the time of termination.
- 44.4 If the Contractor is an individual or a proprietary concern and the individual or the proprietor dies and if the contractor is a partnership concern and one of the partners dies then unless the Purchaser/Employer is satisfied that the legal representatives of the individual contractor or of the proprietor of proprietary concern and in the case of partnership, the surviving partners, are capable of carrying out and completing the Contract, the Purchaser/Employer shall be entitled to cancel the Contract as to its uncompleted part without being in any way liable to payment of any compensation to the estate of deceased Contractor and/or to surviving partners of the contractor's firm on account of the cancellation of the contract. The decision of the Purchaser/Employer that the legal representatives of the deceased contractor or surviving partners of the contractor's firm cannot carry out and complete the contract shall be final and binding on the parties. In the event of such cancellation, the Purchaser/Employer shall not hold the estate of the deceased Contractor and/or the surviving partner of the Contractor's firm liable to damages for not completing the Contract.

45.0 FRUSTRATION OF CONTRACT

- 45.1 In the event of frustration of the contract of supervening impossibility in items of Section 56 of the Indian Contract Act, parties shall be absolved of their responsibility to perform the balance portion of the contract, subject to provisions contained in sub-clause 45.3 below:
- 45.2 In the event of non-availability or suspension of funds for any reasons whatsoever (except for reason of willful or flagrant breach by the Purchaser/Employer and/or contractor) then the Works under the contract shall be suspended.
- Furthermore, if the Purchaser/Employer is unable to make satisfactory alternative arrangements for financing to the contractor in accordance with the terms of the Contract within three months of the event, the parties hereto shall be relieved from carrying out further obligations under the Contract treating it as frustration of the Contract.
- 45.3 In the event referred to in sub-clauses 44.1 & 44.2 above, the parties shall mutually discuss to arrive at reasonable agreement on all issues including amounts due to either party for the work already done on "Quantum merita" basis which shall be determined by mutual agreement between the parties.

46.0 GRAFTS AND COMMISSIONS, ETC.

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

G. RESOLUTION OF DISPUTES

47.0 SETTLEMENT OF DISPUTES

47.1 Any dispute(s) or difference(s) arising out of or in connection with the Contract shall, to the extent possible, be settled amicably between the parties.

47.2 If any dispute or difference of any kind whatsoever shall arise between the Purchaser/Employer and the Contractor, arising out of the contract for the performance of the works whether during the progress of the Works or after its completion or whether before or after the termination, abandonment or breach of the Contract, it shall, in the first place, be referred to and settled by the Engineer, who, within a period of thirty (30) days after being requested by either party to do so, shall give written notice of his decision to the Purchaser/Employer and the Contractor.

47.3 Save as hereinafter provided, such decision in respect of every matters so referred shall be final and binding upon the parties until the completion of the Works and shall forthwith be given effect to by the contractor who shall proceed with the works with all due diligence, whether he or the Purchaser/Employer requires arbitration as hereinafter provided or not.

47.4 If after the Engineer has given written notice of his decision to the parties, no claim to arbitration has been communicated to him by either party within thirty (30) days from the receipt of such notice, the said decision shall become final and binding on the parties.

47.5 In the event of the Engineer failing to notify his decision as aforesaid within thirty (30) days after being requested as aforesaid, or in the event of either the Purchaser/Employer or the Contractor being dissatisfied with any such decision, or within (30) days, after the expiry of the first mentioned period of thirty (30) days, as the case may be, either party may require that the matters in dispute be referred to arbitration as hereinafter provided.

48.0 ARBITRATION

48.1 All disputes or differences in respect of which the decision, if any, of the Engineer has not become final or binding as aforesaid shall be settled by arbitration in the manner hereinafter provided.

48.1.1 The arbitration shall be conducted by three arbitrators, one each to be nominated by the Contractor and the Purchaser/Employer and third to be appointed as an umpire by both the arbitrators in accordance with the Arbitration & Conciliation Act. If either of the parties fails to appoint its arbitrator within sixty (60) days after receipt of a notice from the other party invoking the Arbitration clause, the arbitrator appointed by the party invoking the arbitration clause shall become the sole arbitrator to conduct the arbitration.

48.1.2 The arbitration shall be conducted in accordance with the provisions of the Arbitration & Conciliation Act, 1996 or any statutory modification thereof. The venue of arbitration shall be **Mizoram** only.

- 48.2 The decision of the majority of the arbitrators shall be final and binding upon the parties. The arbitrators may, from time to time with the consent of all the parties enlarge the time for making the award. In the event of any of the aforesaid arbitrators dying, neglecting, resigning or being unable to act for any reason, it will be lawful for the party concerned to nominate another arbitrator in place of the outgoing arbitrator.
- 48.3 The arbitrator shall have full powers to review and/or revise any decision, opinion, direction, certification or valuation of the Engineer in accordance with the Contract, and neither party shall be limited in the proceedings before such arbitrators to the contents or arguments out before the Engineer for the purpose of obtaining the said decision.
- 48.4 No decision given by the Engineer in accordance with the foregoing provisions shall disqualify him as being called as a witness for giving evidence before the arbitrators on any matter whatsoever relevant to the dispute or difference referred to the arbitrators as aforesaid.
- 48.5 During settlement of disputes and arbitration proceedings, both parties shall be obliged to carry out their respective obligations under the Contract.

49.0 RECONCILIATION OF ACCOUNTS

The Contractor shall prepare and submit every 3 (Three) months, a statement covering payments claimed and the payments received vis-à-vis the works executed, for reconciliation of accounts with the Purchaser/Employer. The Contractor shall also prepare and submit a detailed account of Purchaser/Employer issued Materials received and utilized by him for reconciliation purpose in a format to be discussed and finalized with the Purchaser/Employer before the award of the Contract.

SECTION-2

SPECIAL CONDITIONS OF CONTRACT (SCC)

SPECIAL CONDITIONS OF CONTRACT

1.0 GENERAL INFORMATION

- 1.1 Power & Electricity Department, Mizoram, Aizawl, hereinafter called the Owner for execution of Renovation & Upgradation of Protection System of 132kV Sub Station in the state of Mizoram.
- 1.2 The project shall be executed by the Purchaser/Employer on deposit work basis with funds made available out of the proceeds of the financial assistance received by Government of Mizoram from PSDF and ownership of the aforesaid package shall remain vested with the Purchaser/Employer. All eligible payments against this work shall be made by the Purchaser/Employer under suitable arrangement with the Owner.
- 1.3 "Owner" shall mean Power & Electricity Department, Mizoram, Aizawl. For the purpose of execution of the contract, the contractual activities on the part of the "Owner" wherever context requires so, shall be performed by the Purchaser/Employer.
- 1.4 The respective rights of the Owner and Contractors shall be governed by the Contracts signed between the Purchaser/Employer and the Contractor for the respective packages.

2.0 SCOPE OF WORK

- 2.1 The detailed scope of work covered under this package is specified in Section-6 Activity, Quantification and Broad Scope of Works and is indicated briefly hereunder:
 - 2.1.1 The Scope of Work shall include Design, Engineering, Manufacture, Assembly, Inspection, Testing at manufacturer's work before dispatch, packing, supply, delivery at site, erection and commissioning and testing at site of construction materials and equipments, including insurance during transit and storage.
- 2.2 Before proceeding with the work, the Contractor shall fully familiarize himself with the site conditions. It shall be the responsibility of the Contractor to arrange all inputs required for detailed engineering and execution. The Contractor shall be fully responsible for providing all equipment, materials, system and services specified or otherwise which are required to complete the work and successful testing & commissioning of the project for Renovation & Upgradation of Protection System of 132kV Sub Station within Mizoram.
- 2.3 All materials required for the civil works shall be supplied by the Contractor.

3.0 TAXES & DUTIES

- 3.1 In respect of transactions solely between the Purchaser/Employer and the Contractor (for dispatches made from the Contractor's works), Sales Tax, Excise Duties, local taxes and other levies shall be on the account of the Contractor.
- 3.2 No Concessional Sales Tax declaration forms, as admissible, would be issued to the Contractor by the Government of Mizoram.
- 3.3 Sales Tax on goods incorporated in the Works:
The amount in the Contract Schedule include the Sales Tax on materials, Turnover Tax or any other similar taxes under the Sales Tax Act, etc. and the Purchaser/Employer would not bear any liability on this account. The Purchaser/Employer shall, however, deduct such taxes at source as per the rules and issue TDS Certificate to the Contractor. **All the price quoted shall be inclusive of all Taxes & Duties, Freight & Insurance, other Levies and all other charges prevailing as on date but exclusive of MVAT.** The purchaser shall request MVAT exemption to the concerned Department or the actual amount paid by the contractor towards MVAT shall be reimbursed by the Purchaser subject to production of documentary evidence.

- 3.4 For payment/reimbursement of Sales Tax, in respect of dispatches made directly from Contractor's works, invoices raised by the Contractor shall be accepted as documentary evidence. Similarly, pre-numbered invoices duly signed by authorized signatory will be considered as evidence for payment of Excise Duty.
- 3.5 As regards the Income Tax, surcharge on Income Tax and other corporate taxes the Contractor shall be responsible for such payment to the concerned authorities. The Purchaser/Employer shall however deduct such taxes at source as per the rules and issue TDS Certificate to the contractor.
- 3.6 The statutory deduction of Taxes & Duties at source, related to these works, shall be done by the Purchaser/Employer. TDS so deducted shall be deposited with the relevant tax authorities & TDS Certificates shall be issued by the Purchaser/Employer using Contractor's Permanent A/C Number (PAN).

4.0 TERMS OF PAYMENT

The payment to the Contractor for the performance of the contract will be made by the Purchaser/Employer as per Clause 33.0 of Section-I GCC and as per the guidelines and conditions specified hereunder, all payments made during the Contract will be on on-account payment purpose only.

4.1 Advance Payment

- i) **For Supply of materials and Erection** : Ten percent (10%) of the Contract Price component shall be paid as mobilization advance at 10% simple interest p.a. on presentation of the following and interest on the advance payment shall be calculated from the date of payment to the date of recovery, both days inclusive :
- a) Acceptance of Letter of Award by the Contractor.
 - b) Contractor's detailed Invoice.
 - c) An unconditional & irrevocable Bank Guarantee (on reducing balance basis) for the equivalent amount of advance in accordance with the provisions of Clause 33.7.1 (i)(c), Section-I GCC and as per proforma attached with Section-4 Annexures initially valid up to the contract period. This shall be kept renewed time to time to cover the balance amount and likely period to complete recovery together with interest.
 - d) An unconditional & irrevocable Bank Guarantee for Five percent (5%) of the total Contract Price towards Contract Performance Guarantee (CPG) which shall initially be kept valid up to ninety (90) days after the expiry of Warranty/Guarantee Period of the Equipment as per Clause No. 15.0 of GCC, and shall be extended from time to time till ninety (90) days beyond successful completion of Warranty/Guarantee Period, as may be required under the Contract.
 - e) Detailed PERT Network/ Bar Chart and its approval by the Purchaser/Employer.
- ii) 10% Mobilization Advance with 10% Simple interest against Supply and Erection already released shall be 100% adjusted in the payment of 1st installment of progressive payment.
- iii) Payment of Mobilization Advance for Supply and Erection shall be made separately.

4.2 Progressive Payment for Supply of Materials :

- i) **1st installment** : Payment of 85% (Eighty Five Percent) of the contract price of for supply of materials shall be paid on storage at site and on physical verification by the Engineer-In-charge and submission of the following (Ref : Clause No 4.1(ii) of Section 2 (SCC)):
- a) Materials dispatch instruction issued by the Engineer-In-Chief.
 - b) Store receipt voucher (SRV)/Material Receipt & Handing Over (MRHO) issued by an officer not below the rank of Assistant Engineer or Junior Manager (Stores)
 - c) Manufacturer's Guarantee Certificate of quality
 - d) Material Inspection clearance certificate for dispatch issued by Purchaser/Employer's representative and the contractor's factory inspection report, if any.
 - e) Challan in Original
 - f) Contractor's detailed Invoice & packing list.
 - g) Insurance Policy / Certificate, if any.
 - h) Test Certificates.
- ii) **Final Payment** : Balance 15% (Fifteen Percent) for Supply of materials shall be paid on certification by Engineer-in-Charge/Owner's representative that the items have been installed & commissioned and its taking over by the Purchaser/Employer.

4.3 Progressive Payment for Erection :

- i) **1st installment** : 90% (ninety percent) of the Erection price shall be paid in full after completion of erection work and on physical verification by the Engineer-In-charge depending on the actual work done against each completed erection activity and on certification of the same by the Purchaser/Employer.
- ii) **Final Payment** : The balance 10% (ten percent) of the Erection price shall be paid after successful completion of testing & commissioning of the related contract package and its taking over by the Purchaser/Employer.

4.4 **Commissioning** for the purpose of payments shall mean satisfactory completion of all supplies, erection, commissioning, checks and successful completion of all site tests and continuous energizing of the equipment/ materials at rated voltage as per the Contract and to the satisfaction/ approval of the Purchaser/Employer.

5.0 WORK SCHEDULE

5.1 The successful bidder shall submit his programme for furnishing and erecting the equipments covered under the package. The programme shall be in the form of a Bar Chart/ PERT network identifying key phases in various areas of total work like procurement of raw material/ bought out items/ components, manufacturing, type testing, supply of materials and field activities and testing & commissioning of the equipments. The contract should be completed by **12 months** from the date of LOA.

5.2 The schedule shall be reckoned from the date of issue of Letter of Award. Within 30 (thirty) days of issuance of Letter of Award, Contractor shall submit Bar Chart/ PERT Network conforming to the delivery/ erection dates mentioned in Letter of Award for review and approval. After approval of Bar Chart/ PERT Network, one reproducible with sufficient number of prints as desired by the Purchaser/Employer shall be submitted.

5.3 The provisions of Liquidated Damages leviable in case of delay in completion pursuant to Clause 7.0 below shall become effective after the period mentioned above for successful completion of testing & commissioning.

5.4 If the supply of equipment or erection work is delayed due to any reasons, the Contractor shall without delay give notice to the Purchaser in writing of his claim for an extension of time within 30 days of Scheduled Date of Delivery/Completion. The Purchaser on receipt of such notice may agree to extend the Contract Completion Date as may be reasonable but with Liquidated Damages. However, in the case of Force Majeure or in any such cases beyond the control of the Contractor and are accepted as such by the Purchaser, the Completion Date may be extended without Liquidated Damages.

6.0 CONTRACT PERFORMANCE GUARANTEE

The Contractor shall be required to furnish to the Purchaser/Employer a Contract Performance Guarantee (CPG) for the value of **5% (Five percent) of total Contract Price** as per conditions stipulated in Clause 31.0, Section-1 GCC, which shall be extended from time to time till 90 (ninety) days beyond the actual date of successful completion of warranty period, as may be required under the Contract.

7.0 LIQUIDATED DAMAGES FOR DELAY IN COMPLETION

If the Contractor fails to achieve (1) successful completion of Testing & Commissioning of the projects or (2) complete supply and delivery of materials under the contract to the Consignee, within the specified period given in the Letter of Award, the Contractor shall pay to the Purchaser/Employer as Liquidated Damages and not as penalty, a sum of ½ % (half percent) of the material value not supplied for each calendar month of delay or part thereof. However, the amount of Liquidated Damages for the Contract shall be limited to a maximum of 5% (five percent) of the total Contract Price.

8.0 FUNCTIONAL GUARANTEES, LIQUIDATED DAMAGES FOR NON-PERFORMANCE

8.1 The Contractor shall guarantee that the equipments offered shall meet the rating and performance requirements stipulated for various equipments covered in this specification. The Contractor shall also furnish a declaration and details in the manner prescribed in the relevant schedule for guarantees which shall attract levy of Liquidated Damages for non-performance as given below:

8.2 If the guarantees are not established at factory tests, then the Purchaser/Employer at its discretion may reject or accept the equipment after assessing the Liquidated Damages against the Contractor and such amounts shall be deducted from the Contract Price or otherwise recovered from the Contractor.

8.3 The amount of Liquidated Damages so recoverable shall be without any ceiling and shall not prejudice the Contractor's other liabilities under the Contract in any manner. The Liquidated Damages for short fall in guaranteed parameters and for delay in completion are independent of each other and shall be applicable separately and concurrently.

9.0 STORAGE-CUM-ERECTION INSURANCE

In addition to conditions specified in Clause 37.0, Section-1 GCC following shall also apply:

- 9.1 All the equipment and materials including spares, if any, being supplied by the Contractor shall be kept completely insured by the Contractor at his cost from time of dispatch from the Contractor's Works, upto the completion of erection, testing & commissioning at site and taking over by the Purchaser/Employer in accordance with the Contract.
- 9.2 Further all equipment and materials being supplied by the Purchaser/Employer for erection (as per Technical Specification) shall be kept insured by the Contractor against any loss, damage, pilferage, theft, fire, etc. from the point of unloading upto the time of taking over by the Purchaser/Employer including handling, transportation, storage, erection, testing and commissioning etc.
- 9.3 It will be the responsibility of the Contractor to lodge, pursue and settle all claims with the insurance company in case of any damage, loss, theft, pilferage or fire during execution of Contract and the Purchaser/Employer shall be kept informed about it. The Contractor shall replace the lost/ damaged materials promptly irrespective of the settlement of the claims by the under writers and ensure that the work progress is as per agreed schedules. The losses, if any, in such replacement will have to be borne by the Contractor.

10.0 POWER, WATER & COMMUNICATION

Refer Clause no. 14 & 15 of ECC (Section 4).

11.0 PROGRESS REPORTS

During execution of the Contract, the Contractor shall furnish monthly progress reports to the Purchaser/Employer in a format as specified by the Purchaser/Employer, indicating the progress achieved during the month, and total progress upto the month against scheduled and anticipated completion dates in respect of activities covered in programmes/ schedules referred to above. If called for by the Purchaser/Employer, Contractor shall also furnish to the Purchaser/Employer resources data in a specified format and time schedule. The Contractor shall also furnish any other information that is necessary to ascertain progress, if called for by the Purchaser/Employer.

12.0 LATENT DEFECT WARRANTY

The period of latent defect warranty in terms of clause 15.8, Section-1 GCC shall be limited to 5 (five) years from the date of expiry of Guarantee period.

13.0 FIRST-AID

To deal with emergency/ accidental eventualities at Works site, the Contractor shall make all such arrangements necessary, such as services of Ambulance etc. for transportation to hospital at his own cost.

SECTION: 3

ERECTION CONDITIONS OF CONTRACT (ECC)

ERECTION CONDITION OF CONTRACT

1.0 GENERAL

- 1.1 The following shall supplement the conditions already contained in the other parts of these specifications and document and shall govern the portion of the work of this Contract to be performed at Site.
- 1.2 The Contractor upon signing of the Contract shall, in addition to a Project Coordinator, nominate another responsible officer as his representative at Site suitably designated for the purpose of overall responsibility and co-ordination of the works to be performed at Site. Such person shall function from the Site Office of the Contractor during the pendency of Contract.

2.0 REGULATION OF LOCAL AUTHORITIES AND STATUTES

- 2.1 The Contractor shall comply with all the rules and regulations of local authorities during the performance of his field activities. He shall also comply with the Minimum Wages Act, 1948 and the Payment of Wages Act (both of the government of India/ and the State Govt.) & The Industrial Dispute Act, 1947, The Contract Labour (R&A) Act, 1972, The Workmen Compensation Act, 1923 & relevant Labour Acts and rules made there under in respect of any employee or workman employed or engaged by him.
- 2.2 All registration and statutory inspection fees, if any, in respect of his work pursuant to this Contract shall be to the account of the Contractor. However, any registration, statutory inspection fees lawfully payable under any statutory laws and its amendments from time to time during erection in respect of the equipment ultimately to be owned by the Purchaser/Employer, shall be to the account of the Purchaser/Employer. Should any such inspection or registration need to be re-arranged due to the fault of the Contractor, the additional fees which inspection and/or registration shall be borne by the Contractor.

3.0 PURCHASER/EMPLOYER'S LIEN ON EQUIPMENT

The Purchaser/Employer shall have lien on all equipment including those of the Contractor brought to the Site for the purpose of erection, testing and commissioning of the equipment to be supplied and erected under the Contract. The Purchaser/Employer shall continue to hold the lien on all such equipment throughout the period of Contract. No material brought to the site shall be removed from the Site by the Contractor without the prior written approval of the Engineer.

4.0 INSPECTION, TESTING AND INSPECTION CERTIFICATES

The provisions of the clause entitled Inspection, Testing and Inspection Certificates under Technical Specification, section-3 GTC shall also be applicable to the erection portion of the Works. The Engineer shall have the right to re-inspect any equipment though previously inspected and approved by him at the Contractor's works, before and after the same are erected at Site. If by the above inspection, the Engineer rejects any equipment, the Contractor shall make good for such rejections either by replacement or modification/repairs as may be necessary to the satisfaction of the Engineer. Such replacements will also include the replacement or re-execution of such of those works of other Contractors and or agencies, which might have got damaged or affected by the replacements or re-work done to the Contractor's work.

5.0 ACCESS TO SITE AND WORKS ON SITE

- 5.1 Suitable access to the Site shall be afforded to the Contractor by the Owner/Employer in reasonable time.
- 5.2 The Purchaser/Employer shall have the necessary foundations to be provided by him ready, as per the agreed schedule for the execution of the individual phases of works.
- 5.3 The works so far as it is carried out on the Purchaser/Employer's premises shall be carried out at such time as the Purchaser/Employer may approve and the Purchaser/Employer shall give the Contractor reasonable facilities for carrying out the works.
- 5.4 In the execution of the works, no person other than the Contractor or his duly appointed representative, workmen, shall be allowed to do work on the Site, except by the special permission, in writing of the Engineer or his representative.

6.0 CONTRACTORS SITE OFFICE ESTABLISHMENT

The Contractor shall establish a Site Office at the Site and keep posted an authorized representative for the purpose of the Contract. Any written order or instruction of the Engineer or his duly authorized representative shall be communicated to the said authorized resident representative of the Contractor and the same shall be deemed to have been communicated to the Contractor at his legal address.

7.0 CO-OPERATIONS WITH OTHER CONTRACTORS

- 7.1 The Contractor shall co-operate with all other Contractors or tradesmen of the Purchaser/Employer, who may be performing other works on behalf of the Purchaser/Employer and the workmen who may be employed by the Purchaser/Employer and doing work in the vicinity of the Works under the Contract. The Contractor shall also so arrange to perform his work as to minimize, to the maximum extent possible, interference with the work of other contractors and their workmen. Any injury or damage that may be sustained by the employees of the other Contractors and the Purchaser/Employer, due to the Contractor's work shall promptly be made good at the contractor's own expenses. The Engineer shall determine the resolution of any difference or conflict that may arise between the contractor and other Contractors or between the Contractor and the workmen of the Purchaser/Employer in regard to their work. If the work of the Contractor is delayed because of any acts of omission of another contractor, the Contractor shall have no claim against the Purchaser/Employer on that account other than an extension of time for completing his works.
- 7.2 The Engineer shall be notified promptly by the Contractor of any defects in the other Contractor's works that could affect the Contractor's works. The Engineer shall determine the corrective measures if any required to rectify this situation after inspection of the works and such decisions by the Engineer shall be binding on the Contractor.

8.0 DISCIPLINE OF WORKMEN

The contractor shall adhere to the disciplinary procedure set by the Engineer in respect of his employees and workmen at Site. The Engineer shall be at liberty to object to the presence of any representative or employee of the Contractor at the Site, if in the opinion of the Engineer such employee has misconduct himself or is incompetent or negligent or otherwise undesirable and then the Contractor shall remove such a person objected to and provide in his place a competent replacement.

9.0 CONTRACTOR'S FIELD OPERATION

- 9.1 The Contractor shall keep the Engineer informed in advance regarding his field activity plans and schedules for carrying out each part of the works. Any review of such plan or schedule or method of work by the Engineer shall not relieve the Contractor of any of his responsibilities towards the field activities. Such reviews shall also not be considered as an assumption of any risk or liability by the engineer or the Purchaser/Employer or any of his representatives and no claim of the Contractor will be entertained because of the failure or inefficiency of any such plan or schedule or method of work reviewed. The Contractor shall be solely responsible for the safety, adequacy and efficiency of plant and equipment and his erection methods.
- 9.2 The Contractor shall have the complete responsibility for the conditions of the Work Site including the safety of all persons employed by him and all the properties under his custody during the performance of the work. This requirement shall apply continuously till the completion of the contract and shall not be limited to normal working hours. The construction review by the Engineer is not intended to include review of Contractor's safety measures in, on or near the work Site, and their adequacy or otherwise.

10.0 PROGRESS REPORT

- 10.1 The Contractor shall submit to the Purchase/Employer, a monthly progress report detailing out the progress achieved on all activities as compared to the schedules. The report shall also indicate the reasons for the variance between the scheduled and actual progress and the action proposed for corrective measures, wherever necessary.

11.0 MAN-POWER REPORT

- 11.1 The contractor shall submit to the Engineer, on the first day of every month, a man hour schedule for the month, detailing the man hours scheduled for the month, skill-wise and area-wise.
- 11.2 The Contractor shall also submit to the Engineer, on the first day of every month, a man power report of the previous month detailing the number of persons scheduled to have been employed and actually employed, skill-wise and the areas of employment of such labour.

12.0 PROTECTION OF WORK

The Contractor shall have total responsibility for protecting his works till it is finally taken over by the Engineer. No claim will be entertained by the Purchaser/Employer or by the Engineer for any damage or loss to the Contractor's works and the Contractor shall be responsible for complete restoration of the damaged works to original conditions to comply with the specification and drawings, should any such damage to the contractor's works occur because of any other party not being under his supervision or control. The contractor shall make his claim directly with the party concerned. If disagreement or conflict or dispute develops between the contractor and the other party or parties concerned regarding the responsibility for damage to the contractor's works, the same shall be resolved as per the provisions of the Clause 7.0 above entitled "Cooperation with other contractors". The contractor shall not cause any delay in the repair of such damaged works because of any delay in the resolution of such dispute. The contractor shall proceed to repair the work immediately and no cause thereof will be assigned pending resolution of such disputes.

13.0 EMPLOYMENT OF LABOUR

- 13.1 The Contractor will be expected to employ on the work only his regular skilled employees with experience of his particular work. No female labour shall be employed after darkness. No person below the age of eighteen years shall be employed.

- 13.2 All traveling expenses including provisions of all necessary transport to and from Site, lodging allowances and other payments to the Contractor's employees shall be the sole responsibility of the Contractor.
- 13.3 The Hours of work on the Site shall be decided by the Purchaser/Employer and the Contractor shall adhere to it. Working hours will normally be eight (8) hours per day & 48 hours in a week.
- 13.4 The contractor's employees shall wear identification badges while on work at Site.
- 13.5 In case the Purchaser/Employer becomes liable to pay any wages or dues to the labour or any Government agency under any of the provisions of the Minimum Wages Act, Workmen Compensation Act, Contract Labour (Regulation & Abolition) Act, or any other laws due to act of omission of the Contractor, the Purchaser/Employer may make such payments and shall recover the same from the Contractor's bills.

13.6 Compliance with Labour Regulations

- 13.6.1 During continuance of the contract, the Contractor shall abide at all times by all applicable existing labour enactments and rules made there-under, regulations, notifications and byelaws of the State or Central Government or local authority and any other labour law (including rules), regulations, bye laws that may be passed or notifications that may be issued under any labour law in future either by the State or the Central Government or the local authority. The employees of the Contractors in no case shall be treated as the employees of the Purchaser/Employer at any point of time.
- 13.6.2 The Contractor shall keep the Purchaser/Employer indemnified in case any action is taken against the Purchaser/Employer by the Competent Authority on account of contravention of any of the provisions of any Act or rules made there under, regulations, or notifications including amendments.
- 13.6.3 If the Purchaser/Employer is caused to pay under any law as Principal Employer such amount as may be necessary to cause or observe, or for non-observance of the provisions stipulated in the Notifications / byelaws/ Acts/ Rules/ Regulations including Amendments. If any, on the part of the Contractor, the Purchaser/Employer shall have the right to deduct any money due to the Contractor under this contract or any other contract with the Purchaser/Employer including his amount of Performance security for adjusting the aforesaid payment. The Purchaser/Employer shall also have the right to recover from the Contractor any sum required or estimated to be required for making good the loss or damage suffered by the Purchaser/Employer.

14.0 FACILITIES TO BE PROVIDED BY THE PURCHASER/EMPLOYER

14.1 Space for storage of materials

The Engineer shall at his discretion and for the duration of execution of the Contract make available at site, space for storage of materials required for execution of the Contract. Any construction of temporary roads, offices, workshop etc. as per plan approved by the Engineer shall be done by the Contractor at his cost.

14.2 Electricity

Power supply required for construction purpose shall be provided by the Purchase/Employer which shall be charges at the prevailing tariff of domestic category. Power supply requirement for all testing and commissioning of the equipment shall be free of cost. The supply may be withdrawn if it is used for the purposes other than for the work of the project and the

Contractor shall not be entitled to any claim whatsoever on account of any such action taken by the Engineer.

14.3 Water

Water supply required for execution of Work and other related work is the responsibility of the Contractor. Purchaser/Employer is not responsible for supply of water.

15.0 FACILITIES TO BE PROVIDED BY THE CONTRACTOR

15.1 Tools, Tackles and Scaffoldings

The Contractor shall provide all the construction equipments, tools, tackles and scaffoldings required for pre-assembly, erection, testing and commissioning of the equipment covered under the Contract. He shall submit a list of all such materials to the Engineer before the commencement of pre-assembly at Site. These tools and tackles shall not be removed from the Site without the written permission of the Engineer.

15.2 Communication

The Purchaser/Employer will extend the telephone and telex facilities, if available at Site, for purposes of Contract. The Contractor shall be charged at actual for such facilities.

15.3 First - Aid

15.3.1 The Contractor shall provide necessary first-aid facilities for all his employees, representative and workmen working at the Site. Enough number of Contractor's personnel shall be trained in administering first-aid.

15.3.2 The Purchaser/Employer will assist the Contractor, in case of any emergency for the services of an ambulance for transportation to the nearest hospital

15.4 Cleanliness

15.4.1 The Contractor shall be responsible for keeping the entire area allotted to him clean and free from rubbish, debris etc, during the period of Contract. The Contractor shall employ enough number of special personnel to thoroughly clean his work-area at least once in a day. All such rubbish and scrap material shall be stacked or disposed in a place to be identified by the Engineer. Materials and stores shall be so arranged to permit easy cleaning of the area. In areas where equipment might drip oil and cause damage to the floor surface, a suitable protective cover of a flame resistant, oil proof sheet shall be provided to protect the floor from such damage.

15.4.2 Similarly the labour colony, the offices and the residential areas of the Contractor's employees and workmen shall be kept clean and neat to the entire satisfaction of the Engineer. Proper sanitary arrangement shall be provided by the Contractor, in the work areas, office and residential areas of the Contractor.

16.0 LINES AND GRADES

All the works shall be performed on the lines, grades and elevations indicated on the drawings. The contractor shall be responsible to locate and layout the works. Basic horizontal and vertical control points will be established and marked by the Engineer at Site at suitable points. These points shall be used as datum for the works under the contract. The contractor shall inform the Engineer well in advance of the times and places at which he wishes to do work in the area allotted to him so that suitable datum points may be established and checked by the engineer to enable the contractor to proceed with his works. Any work done without being properly located may be removed and/or dismantled by the Engineer at Contractor's expense.

17.0 FIRE PROTECTION

- 17.1 The work procedures that are to be used during the erection shall be those which minimize fire hazards to the extent practicable. Combustible materials, combustible waste and rubbish shall be collected and removed from the Site at least once each day. Fuels, oils and volatile or inflammable materials shall be stored away from the construction and equipment and materials storage areas in safe containers. Un-treated materials shall not at all be used at Site for any other purpose unless otherwise specified. If any such materials are received with the equipment at the Site, the same shall be removed and replaced with acceptable material before moving into the construction or storage area.
- 17.2 Similarly corrugated paper fabricated cartons etc, will not be permitted in the construction area either for storage or for handling of materials. All such materials used shall be of water proof and flame resistant type. All the other materials such as working drawings, plans etc. Which are combustible but are essential for the works to be executed shall be protected against combustion resulting from welding sparks, cutting flames and other similar fire sources.
- 17.3 All the contractor's supervisory personnel and sufficient number of workers shall be trained for fire-fighting and shall be assigned specific fire protection duties. Enough of such trained personnel must be available at the Site during the entire period of the contract.
- 17.4 The contractor shall provide enough fire protection equipment of the types and number for the ware-houses, office, temporary structures, labour colony area etc. Access to such fire protection equipment shall be easy and kept open at all time.

18.0 SECURITY

The contractor shall have total responsibility for all equipment and materials in his custody/stores, loose, semi-assembled and/or erected by him at Site. The contractor shall make suitable security arrangements including employment of security personnel to ensure the protection of all materials, equipment and works from theft, fire, pilferage and any other damages and loss. All materials of the contractor shall enter and leave the project site only with the written permission of the Engineer in the prescribed manner.

19.0 CONTRACTOR'S AREA LIMITS

The Engineer will mark-out the boundary limits of access roads, parking spaces, storage and construction areas for the contractor and the contractor shall not trespass the areas not so marked out for him, The contractor shall be responsible to ensure that none of his personnel move out of the areas marked out for his operations. In case of such a need for the contractor's personnel to work out of the areas marked out for him, the same shall be done only with the written permission of the Engineer.

20.0 CONTRACTOR'S CO-OPERATION WITH THE PURCHASER/EMPLOYER

In case where the performance of the erection work by the Contractor affects the operation of the system facilities of the Purchaser/Employer, such erection work of the contractor shall be scheduled to be performed only in the manner stipulated by the Engineer and the same shall be acceptable at all times to the contractor. The Engineer may impose such restrictions on the facilities provided to the contractor such as electricity, water etc. as he may think fit in the interest of the Purchaser/Employer and the contractor shall strictly adhere to such restrictions and co-operate with the Engineer. It will be the responsibility of the contractor to provide all necessary temporary instrumentation and other measuring devices required during start-up and operation of the equipment systems which are erected by him. The contractor shall also be responsible for flushing and initial filling of all the oil and lubricants required for the equipment ready for operation. The contractor shall be responsible for supplying such

flushing oil and other lubricants unless otherwise specified elsewhere in the document and specification.

21.0 PRE-COMMISSIONING TRIALS AND INITIAL OPERATIONS

The pre-commissioning trials and initial operations of the equipment furnished and erected by the Contractor shall be the responsibility of the Contractor as detailed in relevant clauses in Technical Specifications. The Contractor shall provide, in addition, test instruments, calibrating devices, etc. and labour required for successful performance of these trials. If it is anticipated that the above test may prolong for a long time, the Contractor's workmen required for the above test shall always be present at Site during such trials.

22.0 MATERIALS HANDLING AND STORAGE

- 22.1 All the equipment furnished under the contract and arriving at Site shall be promptly received, unloaded, transported and stored in the storage spaces by the Contractor.
- 22.2 Contractor shall be responsible for examining all the shipment and notify the Engineer immediately of any damage, shortage, discrepancy etc. for the purpose of Engineer's information only. However, the contractor shall be solely responsible for any shortages or damage in transit, handling and/or in storage and erection of the equipment at Site. Any demurrage, wharf age and other such charges claimed by the transporters railways etc. shall be to the account of the contractor.
- 22.3 The contractor shall maintain an accurate and exhaustive record detailing out the list of all equipment received by him for the purpose of erection and keep such record open for the inspection of the Engineer-in-Charge.
- 22.4 All equipment shall be handled very carefully to prevent any damage or loss. No bare wire ropes, slings, etc. shall be used for unloading and/or handling of the equipment without the specific written permission of the Engineer. The equipment stored shall be properly protected to prevent damage either to the equipment or the floor where they are stored. The equipment from the store shall be moved to the actual location at the appropriate time so as to avoid any damage to the equipments.
- 22.5 All electrical panels, control gears, motors and such other devices shall be properly dried by heating before they are installed and energized. Motor bearings, slip rings, commutators and other exposed parts shall be protected against moisture ingress and corrosion during storage and periodically inspected.
- 22.6 All the electrical equipment shall be tested for insulation resistance at least once in three months from the date of receipt till the date of commissioning and a record of such measured insulation values maintained by the Contractor. Such records shall be open for inspection by the Engineer.
- 22.7 The contractor shall ensure that all the packing materials and protection devices used for the various equipment during transit and storage are removed before the equipment are installed.
- 22.8 The consumable and other supplies likely to deteriorate due to storage must be thoroughly protected and stored in a suitable manner to prevent damage or deterioration in quality by storage.
- 22.9 All the materials stored in the open or dusty location must be covered with suitable weather-proof and flame proof covering material wherever applicable.

- 22.10 If the materials belonging to the Contractor are stored in areas other than those earmarked for him, the Engineer will have the right to get it moved to the area earmarked for the contractor at the contractor's cost.
- 22.11 The Contractor shall be responsible for making suitable indoor storage facilities to store all equipment, which require indoor storage. Normally, all the electrical equipment such as motors, control gear, generators, exciters and consumables like electrodes, lubricants etc. shall be stored in the closed storage space. The Engineer, in addition, may direct the Contractor to move certain other materials, which in his opinion will require indoor storage, to indoor storage areas which the contractor shall strictly comply with.

23.0 CONSTRUCTION MANAGEMENT

- 23.1 The field activities of the contractors working at Site will be coordinated by the Engineer and the Engineer's decision shall be final in resolving any disputes or conflicts between the contractor and other contractors and tradesmen of the Purchaser/Employer regarding scheduling and co-ordination of work. Such decision by the Engineer shall not be a cause for extra compensation or extension of time for the Contractor.
- 23.2 The Engineer may call for meeting either with individual contractors or with selected number of contractors and in such a case the contractor if called, will also attend such meetings.
- 23.3 Time is the essence of the Contract and the contractor shall be responsible for performance of his works in accordance with the specified construction schedule. If at any time, the contractor is falling behind the schedule, he shall take necessary action to make good for such delays by increasing his work force or by working overtime or otherwise accelerate the progress of the work to comply with the schedule and shall communicate such actions in writing to the Engineer, satisfying that his action will compensate for the delay. The contractor shall not be allowed any extra compensation for such action.
- 23.4 The Engineer shall, however, not be responsible for provision of additional labour and/or materials or supply or any other services to the contractor except for the coordination work between various contractors as set out earlier.

24.0 FIELD OFFICE RECORDS

The Contractor shall maintain at his Site office up-to-date copies of all drawings, specifications and other contract. Documents and any other supplementary data complete with all the latest revisions thereto. The contractor shall also maintain in addition the continuous record of all changes to the above Contract Documents, drawings, specifications, supplementary data, etc. effected at the field and on completion of his total assignment under the contract shall incorporate all such changes on the drawings and other engineering data to indicate as installed conditions of the equipment furnished and erected under the contract. Such drawings and engineering data shall be submitted to the Engineer in required number of copies.

25.0 CONTRACTOR'S MATERIALS BROUGHT ON TO SITE

- 25.1 The Contractor shall bring to Site all equipment, components, parts, materials, including construction equipment, tools and tackles for the purpose of the work under intimation to the Engineer. All such goods shall, from the time of their being brought vest in the Purchaser/Employer, but may be used for the purpose of the Works only and shall not on any account be removed or taken away by the Contractor without the written permission of the

Engineer. The Contractor shall nevertheless be solely liable and responsible for any loss or destruction thereof and damage thereto.

- 25.2 The Purchaser/Employers shall have a lien on such goods for any sum or sums which may at any time be due or owing to him by the Contractor, under in respect of or by reasons of the Contract. After giving a fifteen (15) days notice in writing of his intention to do so, the Purchaser/Employer shall be at liberty to sell and dispose off any such goods, in such manner as he shall think fit including public auction or private treaty and to apply the proceeds in or towards the satisfaction of such sum or sum due as aforesaid.
- 25.3 After the completion of the Works, the Contractor shall remove from the Site under the direction of the Engineer the materials such as construction equipment, erection tools and tackles, scaffolding etc. with the written permission of the Engineer. If the Contractor fails to remove such materials, within fifteen (15) days of issue of a notice by the Engineer to do so then the Engineer shall have the liberty to dispose of such materials as detailed under clause 25.2 above and credit the proceeds thereto to the account of the Contractor.

26.0 PROTECTION OF PROPERTY AND CONTRACTOR'S LIABILITY

- 26.1 The Contractor shall be responsible for any damage resulting from his operations. He shall also be responsible for protection of all persons including members of public and employees of the Purchaser/Employer and the employees of other contractors and all public and private property including structures, building, other plants and equipment and utilities either above or below the ground.
- 26.2 The Contractor will ensure provision of necessary safety equipment such as barriers, sign-boards, warning lights and alarms, etc., to provide adequate protection to persons and property. The Contractors shall be responsible to give reasonable notice to the Engineer and the Purchaser/Employer of public or private property and utilities when such property and utilities are likely to get damaged or injured during the performance of his works and shall make all necessary arrangements with such Purchaser/Employers, related to removal and/or replacement or protection of such property and utilities.

27.0 PAINTING

All exposed metal parts of the equipment including piping, structures, railing etc. wherever applicable, after installation unless otherwise surface protected, shall be first painted with at least one coat of suitable primer which matches the shop primer paint used, after thoroughly cleaning all such parts of all dirt, rust, scales, grease, oil and other foreign materials by wire brushing, scraping or sand blasting and the same being inspected and approved by the Engineer for painting. Afterwards, the above parts shall be finished painted with two coats of allowed resin machinery enamel paints. The quality of the finish paint shall be as per the standards of ISI or equivalent and shall be of the colour as approved by the Engineer.

28.0 INSURANCE

- 28.1 In addition to the conditions covered under the Clause entitled "Insurance" in General Terms and conditions of Contract of this volume-I, the following provisions will also apply to the portion of works to be done beyond the Contractor's own.

28.2 Workmen's Compensation Insurance

This insurance shall protect the Contractor against all claims applicable under the Workmen's Compensation Act, 1948 (Government of India). This policy shall also cover the Contractor against claims for injury, disability, disease or death of his employee, which for any reasons are not covered under the Workmen's Compensation Act, 1948. The liabilities shall not be less than:

Workmen's Compensation: As per statutory provisions.

Employee's liability: As per statutory provisions.

28.3 Comprehensive Automobile Insurance

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

28.4 Comprehensive General Liability Insurance

28.4.1 The insurance shall protect the contractor against all claims arising from injuries, disabilities, disease or death of members of public or damage to property of others, due to any act or omission on the part of the Contractor, his agents his employees, his representatives or from riots, strikes and civil commotion. This insurance shall also cover all the liabilities of the Contractor arising out of the Clause entitled Defence of Suits under General Terms and Conditions of Contract of this volume-I.

28.4.2 The hazards to be covered will pertain to all the works and areas where the Contractor, his agents and his employees have to perform work pursuant to the contract.

28.5 The above are only illustrative list of insurance covers normally required and it will be the responsibility of the Contractors to maintain all necessary insurance coverage to the extent both in time and amount to take care of all his liabilities either direct or indirect, in pursuance of the Contract.

29.0 UNFAVOURABLE WORKING CONDITIONS

The Contractor shall confine all his field operations to those works which can be performed without subjecting the equipment and materials to adverse effects during inclement weather conditions, like monsoon, storms, etc. and during other unfavorable construction conditions. No field activities shall be performed by the Contractor under conditions which might adversely affect the quality and efficiency thereof, unless special precautions or measures are taken by the Contractor in a proper and satisfactory manner in the performance of such works and with the concurrence of the Engineer. Such unfavorable constructions conditions will in no way relieve the Contractor of his responsibility to perform the Works as per the Schedule.

30.0 WORK & SAFETY REGULATIONS

30.1 The Contractor shall ensure proper safety of all the workmen, materials plant and equipment belonging to him or to Employer/Owner or to others, working at the Site. The Contractor shall also be responsible for provision of all safety notices and safety equipment required both by the relevant legislations and the Engineer as he may deem necessary.

- 30.2 The Contractor will notify well in advance to the Engineer of his intention to bring to the Site any container filled with liquid or gaseous fuel or explosive or petroleum substance or such chemicals which may involve hazards. The Engineer shall have the right to prescribe the conditions, under which such container is to be stored, handled and used during the performance of the works and the Contractor shall strictly adhere to comply with such instructions. The Engineer shall have the right at his sole discretion to inspect any such container is required to be used and if in his opinion, its use is not safe, he may forbid its use.
- 30.3 All equipment used in construction and erection by Contractor shall meet Indian/ International Standards and where such standards do not exist, the Contractor shall ensure these to be absolutely safe. All equipments shall be strictly operated and maintained by the Contractor in accordance with manufacturer's operation Manual and safety instructions and as per guidelines / Rules of State in this regard.
- 30.4 The Contractor shall provide suitable safety equipment of prescribed standard to all employees and workmen according to the need, as may be directed by Engineer who will also have right to examine these safety equipment to determine their suitability, reliability, acceptability and adaptability.
- 30.5 The Contractor shall provide safe working conditions to all workmen and employees at the Site including safe means of access, railings, stairs, ladders scaffoldings, etc. The scaffoldings shall be erected under the control and supervision of an experienced and competent person. For erection, good and standard quality of material only shall be used by the Contractor.
- 30.6 The Contractor shall not interfere or disturb electric fuses, wiring and other electrical equipment belonging to the Purchaser/Employer or other contractor under any circumstances, whatsoever, unless expressly permitted in writing by Engineer to handle such fuses, wiring or electrical equipment.
- 30.7 Before the contractor connects any electrical appliances to any plug or socket belonging to the other contractor or Purchaser/Employer, he shall:
- a) Satisfy the Engineer that the appliance is in good working condition
 - b) Inform the Engineer of the maximum current rating, voltage and phases of the appliances
 - c) Obtain permission of the Engineer detailing the sockets to which the appliances may be connected.
- 30.8 The Engineer will not grant permission to connect until he is satisfied that.
- a) The appliance is in good condition and is fitted with suitable plug.
 - b) The appliance is fitted with a suitable cable having two earth conductors, one of which shall be an earthed metal sheath surrounding the cores.
- 30.9 No electric cable in use by the Contractor/Purchaser/Employer will be disturbed without prior permission. No weight of any description will be imposed on any cable and no ladder or similar equipment will rest against or attached to it.
- 30.10 No repair work shall be carried out on any live equipment. The equipment must be declared safe by the Engineer and a permit to work shall be issued by the Engineer before any repair work is carried out by the Contractor. While working on electric lines/equipment whether live or dead, suitable type and sufficient quantity of tools will have to be provided by Contractor to electricians/workmen/officers.

- 30.11 The Contractors shall employ necessary number of **qualified**, full time electricians/Electrical Supervisors to maintain his temporary electrical installations.
- 30.12 In case any accident occurs during the construction/erection or other associated activities undertaken by the Contractor thereby causing any minor or major or fatal injury to his employees due to any reason, whatsoever, it shall be the responsibility of the Contractor to promptly inform the same to the Engineer in prescribed form and also to all the authorities envisaged under the applicable laws.
- 30.13 The Engineer shall have the right at his sole discretion to stop the work, if in his opinion the work is being carried out in such a way that it may cause accidents and endanger the safety of the persons and/or property, and/or equipment. In such cases, the Contractor shall be informed in writing about the nature of hazards and possible injury/accident and he shall comply to remove shortcomings promptly. The Contractor after stopping the specific work can, if felt necessary, appeal against the order of stoppage of work to the engineer with 3 days of such stoppage or work and decision of the Engineer in this respect shall be conclusive and binding on the Contractor.
- 30.14 The Contractor shall not be entitled for any damages/compensation for stoppage of work due to safety reasons as provided in para 30.13 above and the period of such stoppage of work will not be taken as an extension of time for completion of work and will not be the ground for waiver of levy of liquidated damages.
- 30.15 It is mandatory for the Contractor to observe during the execution of the works, requirements of safety rules which would generally include but not limited to following:

Safety Rules:

- a) Each employee shall be provided with initial indoctrination regarding safety by the Contractor, so as to enable him to conduct his work in a safe manner.
 - b) No employee shall be given a new assignment of work unfamiliar to him without proper introduction as to the hazards incident thereto, both to himself and his fellow employees.
 - c) Under no circumstances shall an employee hurry or take unnecessary chance when working under hazardous conditions.
 - d) Employees must not leave naked fires unattended. Smoking shall not be permitted around fire prone areas and adequate firefighting equipment shall be provided at crucial locations.
 - e) Employees under the influence of any intoxicating substance, even to the slightest degree shall not be permitted to remain at work.
 - f) There shall be a suitable arrangement at every work site for rendering prompt and sufficient first aid to the injured.
 - g) The staircases and passage ways shall be adequately lighted.
 - h) The employees when working around moving machinery must not be permitted to wear loose garments. Safety shoes are recommended when working in shops or places where materials or tools are likely to fall. Only experienced workers shall be permitted to go behind guard rails or to clean around energized or moving equipment.
 - i) The employees must use the standard protection equipment intended for each job. Each piece of equipment shall be inspected before and after it is used.
- 30.16 The Contractor shall follow and comply with all State Safety Rules, relevant provisions of applicable laws pertaining to the safety of workmen, employees, plant and equipment as may be prescribed from time to time without any demur, protest or contest or reservation. In case

of any discrepancy between statutory requirement and State Safety Rules referred above, the later shall be binding on the Contractor unless the statutory provisions are more stringent.

30.17 If the Contractor fails in providing safe working environment as per State Safety Rules or continues the work even after being instructed to stop work by the Engineer as above, the Contractor shall promptly pay to Engineer on demand by the Purchaser/Employer compensation at the rate of Rs. 5000/- per day or part thereof till the instructions are so complied with and so certified by the Engineer. However, in case of accident taking place causing injury, to any individual, the provisions contained in para 30.18 shall also apply in addition to compensation mentioned in this para.

31.18 If the Contractor does not take all safety precautions and/or fails to comply with the Safety Rules as prescribed by the company or under the applicable law for the safety of the equipment and plant and for the safety of personnel and the Contractor does not prevent hazardous conditions which cause injury to his own employees or employees of other contractors, or Purchaser/Employer's Employees or any other person who are at site or adjacent thereto, the Contractors shall be responsible for payment of compensation to members as per the following schedule:

a) Fatal injury or accident causing Death	Rs.1,00,000/- per Person	There are applicable for death/injury to any person whosoever
b) Major injuries or Accident causing 25% or more permanent disablement to workmen or employees	Rs.20,000/- per Person	

Permanent disablement shall have same meaning as indicated in Workmen's Compensation Act. The compensation mentioned above shall be in addition to the compensation payable to the workmen/employees under the relevant provisions of the Workmen's Compensation Act and rules framed hereunder or any other applicable laws as applicable from time to time. In case the Purchaser/Employer is made to pay such compensation then the Contractor is liable to reimburse the Purchaser/Employer such amount in addition to the compensation indicated above.

32.0 CODE REQUIREMENTS

The erection requirements and procedures to be followed during the installation of the equipment shall be in accordance with the relevant Codes and accepted good engineering practice, the Engineer's Drawings and other applicable Indian recognized codes and laws and regulations of the Government of India.

33.0 FOUNDATION DRESSING & GROUTING

33.1 The surfaces of foundation shall be dressed to bring the top surface of the foundation to the required level, prior to placement of equipment / equipment bases on the foundation.

33.2 All the equipment bases and structural steel base plates shall be grouted and finished as per these specifications unless otherwise recommended by the equipment manufacturer.

33.3 The concrete foundation surfaces shall be properly prepared by chipping and / or grinding as required to bring the type of such foundation to the required level to provide the necessary roughness for bondage and to ensure enough bearing strength. All laitance and surface film shall be removed and cleaned.

33.4 Grouting Mix

The grouting mixture shall be composed of Portland cement, sand and water. The Portland cement to be used shall conform to ISI No. 269 or equivalent. Sand shall conform to ISI No. 383/2386 or equivalent. The grout proportions for flat bases where the grouting space does not exceed 35 mm shall be 50 kg. bag of cement to 75 kg. of sand. Only the required quantity of water shall be added so as to make the mix quaky and flowable and the mix shall not show excess water on top when it is being puddle in place. For thicker grout beds upto 65 mm, the amount of sand shall be increased to 105 kg. per bag of cement. Bases which are hollow and are to be filled full of grouting shall be filled to a level of 25 mm above the outside rim with a mortar mix in the volumetric proportion of one part of cement and 1.5 part sand and 1.5 part 6 mm granite gravel. An acceptable plasticizer may be added to the grout mixes in a proportion recommended by the plasticiser's manufacturer. All such grouts shall be thoroughly mixed for not less than five minutes in an approved mechanical mixer and shall be used immediately after mixing.

33.5 Placing of Grout

33.5.1 After the base has been prepared, its alignment and level has been checked and approved and before actually placing the grout a low dam shall be set around the base at a distance that will permit pouring and manipulation of the grout. The height of such dam shall be at least 25 mm above the bottom of the base. Suitable size and number of chains shall be introduced under the base before placing the grout, so that such chains can be moved back and forth to push the grout into every part of the space under the base.

33.5.2 The grout shall be poured either through grout holes provided or shall be poured at one side or at two adjacent sides giving it a pressure head to make the grout move in a solid mass under the base and out in the opposite side. Pouring shall be continued until the entire space below the base is thoroughly filled and the grout stands at least 25 mm higher all around than the bottom of the base. Enough care should be taken to avoid any air or water pockets beneath the bases.

33.6 Finishing of the Edges of the Grout

The poured grout should be allowed to stand undisturbed until it is well set. Immediately thereafter, the dam shall be removed and grout, which extends beyond the edges of the structural or equipment base plates shall be cut off, flushed and removed. The edges of the grout shall then be pointed and finished with 1:2 cement mortar pressed firmly to bond with the body of the grout and smoothed with a tool to present a smooth vertical surface. The work shall be done in a clean and scientific manner and the adjacent floor spaces, exposed edges of the foundations, and structural steel and equipment base plates shall be thoroughly cleaned of any spillage of the grout.

33.7 Checking of Equipment after Grouting

After the grout is set and cured, the Contractor shall check and verify the alignment of equipment, alignment of shafts of rotating machinery, the slopes of all bearings, pedestals, centering of rotors with respect to their sealing bores, couplings, et. as applicable and the like items to ensure that no displacement has taken place during grouting. The values recorded prior to grouting shall be used during such post grouting checkup and verification. Such pre and post grout records of alignment details shall be maintained by the Contractor in a manner acceptable to the Engineer.

34.0 DOWELLING

All the motors and other equipment shall be suitably dowelled after alignment of shafts with tapered machined dowels as per the direction of the Engineer.

35.0 CHECKOUT OF CONTROL SYSTEMS

After completion of writing, cabling furnished under separate specification and laid and terminated by the Purchaser/Employer, the contractor shall check out the operation of all control systems for the equipment furnished and installed under these specifications and documents.

36.0 CABLING

- 36.1 All cables shall be supported by conduits or cable trays run in air or in cable channels. These shall be installed in exposed runs parallel or perpendicular to dominant surface with right angle turn made of symmetrical bends for fittings. When cables are run on cable trays, they shall be clamped at a minimum interval of 2000 mm or otherwise as directed by the Engineer.
- 36.2 Each cable, whether power or control, shall be provided with a metallic or plastic tag of an approved type, bearing a cable reference number indicated in the cable and conduit list (prepared by the Contractor), at every 5 meter run or part thereof and at both ends of the cable adjacent to the terminations. Cable routing is to be done in such a way that cables are accessible for any maintenance and for easy identification.
- 36.3 Sharp bending and kinking of cables shall be avoided. The minimum radii for PVC insulated cables 1100 V grade shall be 15 D is the overall diameter of the cable. Installation of other cables high voltage coaxial, screened, compensating, mineral insulated shall be in accordance with the cable manufacturer's recommendations. Wherever cables cross roads and water, oil, sewage or gas lines, special care should be taken for the protection of the cables in designing the cable channels.
- 36.4 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.
- 36.5 Control cable terminations shall be made in accordance with wiring diagrams, using identifying codes subject to Engineer's approval. Multi core control cable jackets shall be removed as required to train and terminate the conductors. The cable jacket shall be left on the cable, as far as possible, to the point of the first conductor branch. The insulated conductors from which the jacket is removed shall be neatly twined in bundles and terminated. The bundles shall be firmly but not tightly tied utilizing plastic or nylon ties or specifically treated fungus protected cord made for this purpose. Control cable conductor insulation shall be secure and even.
- 36.6 The connectors for control cables shall be covered with a transparent insulating sleeve so as to prevent accidental contact with ground or adjacent terminals and shall preferably be terminated in elmex terminals and washers. The insulating sleeve shall be fire resistant and shall be long enough to over pass the conductor insulation. All control cables shall be fanned out and connection made to terminal blocks and test equipment for proper operation before cables are corded together.

SECTION – 4

ANNEXURES

CONTENTS

<i>Annexure</i>	<i>Description</i>
<i>Annexure-I</i>	<i>Proforma Bank Guarantee for contract performance</i>
<i>Annexure-II</i>	<i>Proforma of Extension of Bank Guarantee</i>
<i>Annexure-III</i>	<i>Proforma of Application for Payment</i>
<i>Annexure- IV</i>	<i>Proforma of Bank Guarantee for Advance Payment</i>

**PROFORMA OF BANK GUARANTEE FOR CONTRACT PERFORMANCE
(To be stamped in accordance with Stamp Act)**

Ref.....

Bank Guarantee No.....

Date.....

To

.....
.....
.....

Dear Sirs,

In consideration of Power & Electricity Department, Govt. of Mizoram., (herein after referred to as the "Owner" which expression shall unless repugnant to the context or meaning thereof include its successors, administrators and assigns) having awarded to M/s.....with registered/Head office at.....(hereinafter referred to as "Contractor" which expression shall unless repugnant to the context or meaning thereof include its successors, administrators, executors and assigns), a Contract issued by Purchaser/Employer's Letter of Award No.....dated..... for í í í í í í í (scope of work) and the same having been acknowledged by the Contractor, resulting in a Contract bearing No.....dated í í í Contractor having agreed to provide a Contract Performance Guarantee for the faithful performance of the entire Contract equivalent to Rs..... being (5%) (Five Percent) of the said value of the Contract to the Purchaser/Employer.

We..... (Name & Address) having its Head Office at.....(hereinafter referred to as the "Bank", which expression shall, unless repugnant to the context or meaning thereof, include its successors, administrators, executors and assigns) do hereby guarantee and undertake to pay the Purchaser/Employer, on demand any or all monies payable by the Contractor to the extent of Rs.....as aforesaid at any time up to.....í í í (day/month/year) without any demur, reservation, contest, recourse or protest and/or without any reference to this Contractor.

Any such demand made by the Purchaser/Employer on the bank shall be conclusive and binding notwithstanding any difference between the Purchaser/Employer and the Contractor or any dispute pending before any Court, Tribunal, Arbitrator or any other authority. The Bank undertakes not to revoke this guarantee during its currency without previous consent of the Purchaser/Employer and further agrees that the guarantee herein contained shall continue to be enforceable till the Purchaser/Employer discharges this guarantee.

The Purchaser/Employer shall have the fullest liberty without affecting in any way the liability of the Bank under the guarantee from time to time to extend the time for performance or the Contract by the Contractor. The Purchaser/Employer shall have the fullest liberty, without affecting this guarantee, to postpone from time to time the exercise of any powers vested in them or of any right which they might have against the Contractor and to exercise the same at any time in any manner and either to enforce or to forbear to enforce any covenants, contained or implied in the Contract between the Purchaser/Employer and the Contractor or any other course or remedy or security available to the Purchaser/Employer. The Bank shall not be relieved of its obligations under

these presents by any exercise by the Purchaser/Employer of its liberty with reference to the matters aforesaid or any of them or by reason of any other act of omission or commission on the part of the Purchaser/Employer or any other indulgences shown by the Purchaser/Employer or by any other matter or thing whatsoever which under law would, but for this provision have the effect of relieving the Bank.

The Bank also agrees that the Purchaser/Employer at its option shall be entitled to enforce this guarantee against the Bank as a principal debtor, in the first instance without proceeding against the Contractor and notwithstanding any security or other guarantee the Purchaser/Employer may have in relation to the Contractor's liabilities.

Notwithstanding anything contained herein above our liability under this guarantee is restricted to Rs.....and it shall remain in force upto and including** (day/month/year) and shall be extended from time to time for such period as may be desired M/s.....on whose behalf this guarantee has been given. Unless a demand or claim is lodged on us within and including í í í í ..*(day/month/year) we shall be discharged from all liabilities thereafter.

Dated this.....day of.....20.....at.....

WITNESS

.....
(Signature)

.....í í í í í ..
(Signature)

.....
(Name)

.....í í í í í ..
(Name)

.....
(Official Address)

.....í í í í í .
(Designation with Bank Stamp)

Attorney as per Power
Of Attorney No.....

Date.....

Notes:

1. The sum shall be 5% (Five percent) of the contract price for Contract Performance Guarantee.
2. The date will be ninety (90) days after the end of Warranty Period as specified in the contract.

Note: The stamp paper of appropriate value shall be purchased in the name of issuing Bank.

PROFORMA OF EXTENSION OF BANK GUARANTEE

Ref.....

Date.....

To

.....
.....
.....

Dear Sirs,

Sub: Extension of Bank Guarantee No.....for Rs..... favoring yourselves, expiring on.....on account of M/s.....in respect of Contract No.....dated..... (hereinafter called original Bank Guarantee).

At the request of M/s....., We.....Bank, branch office at.....and having its Head Office at.....do hereby extend our liability under the above mentioned Bank Guarantee No..... dated..... for a further period of.....(Years/Months) from.....to expire on..... Expect as provided above, all other terms and conditions of the original bank guarantee No.....dated.....shall remain unaltered and binding.

Please treat this as an integral part of the original bank guarantee to which it would be attached.

Yours Faithfully,

For.....
Manager/Agent/Accountant.....
Power of Attorney No.....
Dated.....

SEAL OF BANK

NOTE: The non-judicial stamp paper of appropriate value shall be purchased in the name of the bank who has issued the Bank Guarantee.

PROFORMA OF APPLICATION FOR PAYMENT

Project: _____

Equipment package:

Date:

Name of Contractor:

Contract No.

Contract Value:

Contract Name:

Unit Reference:

Application:

Serial Number:

To

.....
.....
.....

Dear Sir,

APPLICATION FOR PAYMENT

1. Pursuant to the above referred Contract, dated.....the undersigned hereby applies for payment of the sum of.....(Specify amount and currency in which claim is made).

2. The above amount is on account of : (check whichever applicable)

Mobilization advance (Schedule**)

Interim payment as advance (Schedule**)

Payment of 1st installment against supply of equipment (Schedule**)

Payment of 1st installment against Erection (Schedule**)

Extra work not specified in contract

(Ref. Contract change order No.....)

Other (specify)

Final payment (Schedule**)

as detailed in the attached schedule(s) which form an integral part of this application.

3. The payment claimed is as per item(s) No(s).....of the payment schedule annexed to the above Contract.

4. The application consists of this page, a summary of claim statement (Schedule**) and the following signed schedule.

i)

ii)

iii)

The following documents are also enclosed:

i)

ii)

iii)

Signature of Contractor/
Authorised Signatory

* Application for payment will be made to the Controlling Officer.

Prepare separate application for each claim.

** Proforma for the Schedules will be mutually discussed and agreed to during the finalization of the Contract Agreement.

**PROFORMA OF BANK GUARANTEE FOR ADVANCE PAYMENT
(To be stamped in accordance with Stamp Act)**

Ref.....

Bank Guarantee No.....

Date.....

To

.....
.....
.....

Dear Sir,

In consideration of Power & Electricity Department, Govt. of Mizoram., (hereinafter referred to as the 'Owner', which expression shall unless repugnant to the context or meaning thereof include its successors, administrators and assigns) having awarded to M/s.....(hereinafter referred to as the 'Contractor' which expression shall, unless repugnant to the context or meaning thereof, include its successors, administrators, executors and assigns), a Contract by issue of Purchaser/Employer's Letter of Award No.....dated.....and the same having been acknowledged by the Contractors, resulting in a Contract bearing No.....dated..... valued (at.....(in words and figures) for.....Contract (scope of work)..... (hereinafter called the 'Contract') and the Purchaser/Employer having agreed to make an advance payment to the Contractor for performance of the above Contract amounting to Rs..... (in words and figures) as an advance against Bank Guarantee to be furnished by the contractor.

We.....(Name of the Bank) having its Head Office at..... (hereinafter referred to as the 'Bank' which expression shall, unless repugnant to the context or meaning thereof, include its successors, administrators, executors and assigns) do hereby guarantee and undertake to pay the Purchaser/Employer, immediately on demand any or, all monies payable by the Contractor to the extent of Rs.....as aforesaid at any time upto and including.....í í í í í @.(day/month/year) without any demur, reservation, contest, recourse or protest and/or without any reference to the Contractor. Any such demand made by the Purchaser/Employer on the bank shall be conclusive and binding notwithstanding any difference between the Purchaser/Employer and the Contractor or any dispute pending before any Court, Tribunal, Arbitrator or any other authority. We agree that the guarantee herein contained shall be irrevocable and shall continue to be enforceable till the Purchaser/Employer discharge this guarantee .

The Purchaser/Employer shall have the fullest liberty without affecting in any way the liability of the Bank under this guarantee, from time to time to vary the advance or to extend the time for performance of the Contract by the Contractor. The Purchaser/Employer shall have the fullest liberty without affecting this guarantee, to postpone from time to time the exercise of any powers vested in them or of any right which they might have against the Contractor, and to exercise the same at any time in any manner and either to enforce any covenants, contained or implied in the Contract between the Purchaser/Employer and the contractor or any other course or remedy or security available to Purchaser/Employer. The Bank shall not be relieved of its obligations under these presents by any exercise by the Purchaser/Employer of its liberty with reference to the matters aforesaid or any of them or by reason of any other act or forbearance or other acts of omission or commission on the part of the Purchaser/Employer or any other indulgence shown by the Purchaser/Employer or by any other matter or thing whatsoever which under law would be for this provision have the effect of relieving the Bank.

The Bank also agrees that the Purchaser/Employer at its option shall be entitled to enforce this guarantee against the Bank as a principal debtor, in the first instance without proceeding against the Contractor and notwithstanding any security or other guarantee that the Purchaser/Employer may have in relation to the Contractor's liabilities.

Notwithstanding anything contained herein above our liability under this guarantee is limited to Rs.....and it shall remain in force upto and including.....(@.....) and shall be extended from time to time for such period as may be desired by M/s..... on whose behalf this guarantee has been given.

Dated this.....day of.....20.....at.....

WITNESS

.....
(Signature)

.....
(Name)

.....
(Official Address)

.....
(Signature)

.....
(Name)

Designation.....
(with Bank Stamp)

as per Power
of Attorney No.....

Dated.....

@ The date will be Three (3) Months after the Scheduled date of completion of Supply / Three (3) Months after taking over the work by P&E Department, Mizoram (Erection).

Note: The non-judicial stamp papers of appropriate value shall be purchased in the name of bank who issued the Bank Guarantee.

SECTION: 5

GENERAL TECHNICAL CONDITIONS (GTC)

GENERAL TECHNICAL CONDITIONS

1.0 GENERAL INFORMATION

- 1.1 The material/equipment covered in this specification shall be used for execution of Renovation & Upgradation of Protection System of 132kV Sub Station in the state of Mizoram. The project is to be executed under Power System Development Fund launched under the Ministry of Power, Government of India.

2.0 SCOPE

- 2.1 The material/equipment to be supplied on each sub stations as covered in this volume shall be designed, manufactured and tested as per the requirements specified.
- 2.2 The materials/equipment covered here under this package shall be supply and erection complete in all respects including all components, fittings and accessories which are necessary or are usual for their efficient performance and satisfactory maintenance under the various operating and atmospheric conditions.

The details of the materials/equipment required for the work have been elaborated in the respective volumes of specification.

3.0 WEIGHTS AND MEASURES

All weights and measures shall be in System International (S.I.) units. All fasteners shall be of Metric size only.

4.0 GENERAL TECHNICAL CONDITIONS

- 4.1 The following provisions shall supplement all the detailed technical specifications and requirements brought out in the accompanying Technical Specifications. The Contractor's proposal shall be based on the use of equipment and materials complying fully with the requirements, specified herein.

The Contractor shall furnish clause-by-clause commentary (with detailed technical data as required) on the Technical Specifications demonstrating the goods substantial responsiveness to the specifications or deviation and exceptions to the provisions of the Technical Specification unless and until advised contrary to this in the contract document.

4.2 Liquidated Damage for not meeting specified performance

- 4.2.1 Liquidated damages for not meeting specified performance shall be assessed and recovered from the Contractor. Such liquidated damages shall be calculated at rate of 0.5% (Half percent) of the Contract Value for each calendar week of delay, which will be limited to 5% (Five percent) of the Contract Value.

4.3 Engineering Data

- 4.3.1 The furnishing of engineering data by the Contractor shall be in accordance with the appropriate Schedule appended to this document. The review of these data by the Owner/Employer will cover only general conformance of the data to the specifications and drawings. This review by the Purchaser/Employer may not indicate a thorough review of all dimensions, quantities and details of the equipment, materials, any devices or items indicated or the accuracy of the information submitted. This review and / or approval by the Purchaser/Employer shall not be considered by the Contractor, as limiting any of his responsibilities and liabilities for mistakes and deviations from the requirement, specified under these Specifications and documents.

- 4.3.2 All engineering data submitted by the Contractor after final process including review and approval by the Purchaser/Employer shall form part of the Contract Document and the entire works performed under these Specifications shall be performed in strict conformity, unless otherwise expressly requested by the Purchaser/Employer in writing.

4.4 Drawings

- 4.4.1 The drawings submitted for approval to the Purchaser/Employer shall be in softcopy of pdf/dwg format and two copies of hardcopy. One print of such drawings shall be returned to the Contractor by the Employer/Purchaser marked 'Approved' / 'Approved with corrections'.
- 4.4.2 Further work by the contractor shall be strictly in accordance with these drawings and no deviation shall be permitted without the written approval of the Purchaser/Employer, if so required.
- 4.4.3 All manufacturing and fabrication work in connection with the equipment/material prior to the approval of the drawings shall be at the Contractor's risk. The Contractor may make any changes in the design which are necessary to make the equipment conform to the provisions and intent of the Contract and such changes will again be subject to approval by the Purchaser/Employer. Approval of Contractor's drawing or work by the Purchaser/Employer shall not relieve the Contractor of any of his responsibilities and liabilities under the Contract.
- 4.4.4 All rights of the design/drawing shall be strictly reserved with the Purchaser/Employer only and any designs/drawings/data sheets submitted by the contractor from time to time shall become the property of the Purchaser/Employer, Under no circumstances, the Contractor shall be allowed to use/offer above designs/drawings/data sheets to any other authority without prior **written** permission of the Purchaser/Employer. **Any deviation to above is not acceptable.**
- 4.4.5 As-Built Drawings should be submitted by the Contractor before handing over the system shall be in complete Bill of Materials with proper locations to the Purchaser/Employer in 2 (two) sets.

4.5 Manufacturing, Supply & Erection Schedule

The Contractor shall submit to the Purchaser/Employer his manufacturing, testing, delivery & erection schedules of various items within thirty (30) days from the date of the Letter of Award in accordance with the delivery requirements stipulated. Schedules shall also include the materials and items purchased from outside Contractors, if any.

4.6 Reference Standards

- 4.6.1 The codes and/or Standard referred to in Specifications shall govern, in all cases wherever such references are made. In case of a conflict between such codes and/or Standards and the specifications, latter shall govern. Such codes and/or Standards, referred to shall mean the latest revisions, amendments/changes adopted and published by the relevant agencies.
- 4.6.2 Other internationally acceptable Standards which ensure equivalent or better performance than those specified shall also be accepted.

4.7 Design Improvements

- 4.7.1 The Purchaser/Employer or the Contractor may propose changes in the Specification of the equipment or quality thereof and if the parties agree upon any such changes the Specification shall be modified accordingly without any escalation in item price.
- 4.7.2 If any such agreed upon change is such that it affects the price and schedule of completion, the parties shall agree in writing as to the extent of any change in the price and/or schedule of

completion before the Contractor proceeds with the change. Following such agreement, the provision thereof, shall be deemed to have been amended accordingly.

4.8 Quality Assurance

4.8.1 To ensure that the equipment under the scope of this Contract whether manufactured within the Contractor's Works/premises is in accordance with the specifications, the Contractor shall adopt suitable Quality Assurance Programme to control such activities at all points necessary.

Such programme shall be outlined by the Contractor and shall be finally approved by the Purchaser/Employer.

Quality Assurance Programme of the Contractor shall generally cover but not limited to the following:

- a) His organization structure for the management and implementation of the proposed Quality Assurance Programme.
- b) Documentation control system.
- c) Qualification data for key personnel.
- d) The procedure for purchases of materials. Parts/components and selection of services including vendor analysis, source inspection, incoming raw material inspection, verification of material purchases etc.
- e) System for shop manufacturing including process controls.
- f) Control of non-conforming items and system for corrective action.
- g) Control of calibration and testing of measuring and testing equipments.
- h) Inspection and test procedure for manufacturing.
- i) System for indication and appraisal of inspection status.
- j) System for Quality audits.
- k) System for authorizing release of manufactured product to the Purchasers.
- l) System for maintenance of records.
- m) System for handling storage and delivery and
- n) A Quality Plan detailing out the specific quality control procedure adopted for controlling the quality characteristic of the product.

The Quality Plan shall be mutually discussed and approved by the Purchaser/Employer after incorporating necessary corrections by the Contractor as may be required.

4.8.2 Quality Assurance Documents

The Contractor shall be required to submit all the Quality Assurance Documents as stipulated in the Quality Plan at the time of Purchaser/Employer's inspection of equipment/material.

4.8.3 The Purchaser/Employer or his duly authorized representatives reserves the right to carry out Quality Audit and Quality surveillance of the systems and procedures of the Contractor's/his vendor's Quality Management and Control Activities.

4.9 Purchaser/Employer's Supervision during manufacturing

4.9.1 To eliminate delays and avoid disputes and litigation it is agreed between the parties to the Contract that all matters and questions shall be resolved in accordance with the provisions of this documents.

4.9.2 The manufacturing of the product shall be carried out in accordance with the specifications. The scope of the duties of the Purchaser/Employer, pursuant to the contract, will include but not be limited to the following:

- a) Interpretation of all the terms and conditions of these Documents and Specifications.

- b) Review and interpretation of all the Contractor's drawings, engineering data etc.
- c) Witness or authorize his representative to witness tests at the manufacturer's works or at site, or at any place where work is performed under the Contract.
- d) Inspect, accept or reject any equipment, material and work under the Contract, in accordance with the Specifications.
- e) Issue certificate of acceptance and / or progressive payment and final payment certificate.
- f) Review and suggest modification and improvement in completion schedules from time to time; and
- g) Supervise the Quality Assurance Programme implementation at all stages of the Works.

4.10 Inspection, Testing & Inspection Certificate

- 4.10.1 The Purchaser/Employer or his duly authorized representative and/or outside inspection agency acting on behalf of the Purchaser/Employer shall have at the reasonable times access to the Contractor's premises or Works and shall have the power at all reasonable times to inspect and examine the materials and workmanship of the product during its manufacture and if part of the product is being manufactured or assembled at other premises or works, the Contractor shall obtain from the Purchaser/Employer and/or his duly authorized representative permission to inspect as if the equipment/materials were manufactured or assembled on the Contractor's own premises or works.
- 4.10.2 The Contractor shall give the Purchaser/Employer/Inspector fifteen (15) days written notice of any material being ready for testing. Such tests shall be to the Contractor's account except for the expenses of the Inspector. The Purchaser/Employer/Inspector, unless witnessing of the tests is virtually waived, will attend such tests within fifteen (15) days of the date of which the equipment is notified as being ready for test/inspection or on a mutually agreed date, failing which the Contractor may proceed with the test which shall be deemed to have been made in the Inspector's presence and he shall forthwith forward to the Inspector duly certified copies of tests in triplicate.
- 4.10.3 The Purchaser/Employer/Inspector shall, within fifteen (15) days from the date of inspection as defined herein give notice in writing to the Contractor, of any objection to any drawings and all or any equipment and workmanship which in his opinion is not in accordance with the Contract. The Contractor shall give due consideration to such objections and shall make the modifications that may be necessary to meet the said objections.
- 4.10.4 When the factory tests have been completed at the Contractor's works, the Purchaser Inspector shall issue a certificate to this effect within fifteen (15) days after completion of tests but if the tests are not witnessed by the Purchaser/Employer/Inspector, the certificate shall be issued within fifteen (15) days of receipt of the Contractor's Test certificate by the Purchaser/Employer/Inspector. The completion of these tests or the issue of the certificate shall not bind the Purchaser/Employer to accept the equipment should it, on further tests after erection, be found not to comply with the Contract.
- 4.10.5 In all cases where the Contract provides for tests whether at the premises or works of, the Contractor, the Contractor except where otherwise specified shall provide free of charge such item as labour, materials, electricity, fuel, water, stores, apparatus and instruments as may be reasonably demanded by the Purchaser/Employer/inspector or his authorized representative to carry out effectively such tests of the equipment in accordance with the Contract and shall give facilities to the Purchaser/Employer/Inspector or to his authorized representative to accomplish testing.

- 4.10.6 The inspection by Purchaser/Employer and issue of Inspection Certificate thereon shall in no way limit the liabilities and responsibilities of the Contractor in respect of the agreed Quality Assurance Programme forming a part of the Contract.

5.0 TECHNICAL DESCRIPTION

- 5.1 The technical description of various materials/equipment has been specified in the respective volumes of technical specifications. Further technical descriptions if necessary after actual site visits, may be included in consultation with the engineers in - charge in writing.

6.0 TESTS AND STANDARDS

6.1 Tests

The following type, acceptance and routine tests and tests during manufacture shall be carried-out on the material. For the purpose of this clause:

- 6.1.1 All equipment offered/supplied should have been type tested as per the relevant standards and certificates of the same shall be submitted to the owner/ employer. In case any equipment is not type tested, the bidder shall carry out the type testing at his own cost and provide the necessary certificates to the Purchaser/Employer for approval.
- 6.1.2 Acceptance Tests shall mean those tests, which are to be carried out on samples taken from each lot offered for pre-dispatch inspection, for the purposes of acceptance of that lot.
- 6.1.3 Routine Tests shall mean those tests, which are to be carried out on the material to check requirements, which are likely to vary during production.
- 6.1.4 Tests During Manufacturing shall mean those tests, which are to be carried out during the process of manufacture and end inspection by the Contractor to ensure the desired quality of the end product to be supplied by him
- 6.1.5 The norms and procedure of sampling for these tests will be as per the Quality Assurance Programme to be mutually agreed to by the Contractor and the Purchaser/Employer or as per relevant I.S.S.
- 6.1.6 The standards and norms to which these tests will be carried out are listed against them. Where a particular test is a specific requirement of this Specification, the norms and procedure of the test shall be as specified separately or as mutually agreed to between the Contractor and the Purchaser/Employer in the Quality Assurance Programme.
- 6.1.7 For all type and acceptance tests, the acceptance values shall be the values specified in the Specification or guaranteed by the Bidder, as applicable. The test and standards for various materials/equipment has been specified in the respective volume of technical specification.

6.2 Testing Expenses

No testing expenses will be borne by the Purchaser/Employer.

6.3 Additional/ Alternative Tests

- 6.3.1 The Purchaser/Employer reserves the right if required necessary arrangements have to be done by contractor out of his own expenses. Any other test(s) of reasonable nature carried out at contractor's premises, at site, or in any other place in addition to the specified type,

acceptance and routine tests to satisfy himself that the materials/equipment comply with the Specifications.

- 6.3.2 The Purchaser/Employer also reserves the right to conduct all the tests mentioned in this specification at his own expense on the samples drawn from the site at Contractor's premises or at any other test center. In case of evidence of non compliance, it shall be binding on the part of contractor to prove the compliance of the items to the technical specifications by repeat tests, or correction of deficiencies, or replacement of defective item all without any extra cost to the Purchaser/Employer.

6.4 Sample Batch for Testing

- 6.4.1 The contractor is required to carry out at the Acceptance tests as specified/as per I.S.S norms successfully in presence of Purchaser/Employer's representative.

7.0 GUARANTEED TECHNICAL PARTICULARS

- 7.1 The Guaranteed Technical Particulars of the various items shall be furnished by the Contractor in one original and two (2) copies in the prescribed schedules of the Volume-III Bid Proposal Sheet. The Contractor shall also furnish any other schedule information as in their opinion is needed to give full description and details to judge the item(s) offered by them.

- 7.2 The Data furnished in Guaranteed Technical Particulars should be the minimum or maximum value (as per the requirement of the specification) required. A Contractor may guarantee a value more stringent than the specification requirement. However, for testing purpose or from performance point of view, the material shall be considered performed successfully if it achieves the minimum / maximum value required as per the technical specification. No preference whatsoever shall be given to the Contractor offering better/ more stringent values than those required as per specifications.

8.0 CLIMATIC CONDITIONS

- 8.1 All Equipment / Material to be supplied against this specification shall suitable for satisfactory continuous operation under tropical conditions of Mizoram.

SECTION: 6

BROAD SCOPE OF WORK
AND
LIST OF ACTIVITIES & QUANTIFICATION OF WORK

BROAD SCOPE OF WORK AND LIST OF ACTIVITIES & QUANTIFICATION OF WORK

1.0 132kV, 66kV AND 33kV CIRCUIT BREAKERS

The work covers :

- a) Design, manufacture, testing at manufacturer's works and of 132kV, 66kV and 33kV Circuit Breakers with all fittings and accessories including mounting structures as applicable.
- b) Loading at manufacturer's works, transportation and delivery at respective substation sites, including unloading at destination sites.
- c) Erection, Testing and Commissioning of Circuit Breakers including dismantling of existing equipments.
- d) The Circuit Breakers shall be used for replacing old and obsolete equipment in the existing substations. The erection work shall be inclusive of construction of new foundation, erection of mounting structure, connection to riser etc. including dismantling of existing equipments etc.
- e) It is the responsibility of Contractor to store the dismantled Circuit breakers in a safe manner at a location inside the substation complex as directed by the site Engineer of P&EDM.

2.0 132kV, 66kV AND 33kV CURRENT TRANSFORMERS

The work covers :

- a) Design, manufacture, testing at manufacturer's works of 132kV, 66kV and 33kV Current Transformer with all fittings and accessories excluding mounting structures as applicable.
- b) Loading at manufacturer's works, transportation and delivery at respective substation sites, including unloading at destination sites.
- c) Erection, Testing and Commissioning of Current Transformers including dismantling of existing equipments.
- d) Most of the equipments shall be used for replacing old and obsolete equipment in the existing substations. The equipment shall be installed on existing mounting structures by retrofitting. Retrofitting also include use of earthing arrangement of existing Current transformers. Hence, Erection work shall be inclusive of all such retrofitting including supply of any materials to complete the job and cost of dismantling of existing equipment.
- e) It is responsibility of Supplier/Contractor to store the dismantled Current transformers in a safe manner at a location inside the substation complex as directed by the site Engineer of P&EDM.

3.0 132kV, 66kV AND 33kV VOLTAGE / POTENTIAL TRANSFORMERS

The work covers :

- a) Design, manufacture, testing at manufacturer's works of 132 kV, 66 kV & 33 kV Voltage Transformer with all fittings and accessories excluding mounting structures.
- b) Loading at manufacturer's works, transportation and delivery at respective substation sites, including unloading at destination sites.
- c) Erection, Testing and Commissioning of Voltage Transformers including dismantling of existing equipments.

- d) Most of the equipments shall be used for replacing old and obsolete equipment in the existing substations. The equipment shall be installed on existing mounting structures by retrofitting. Retrofitting also include use of earthing arrangement of existing Current transformers. Hence, Erection work shall be inclusive of all such retrofitting including supply of any materials to complete the job and cost of dismantling of existing equipment.
- e) It is responsibility of Supplier/Contractor to store the dismantled Current transformers in a safe manner at a location inside the substation complex as directed by the site Engineer of P&EDM.

4.0 132kV CAPACITOR VOLTAGE TRANSFORMERS

The work covers :

- a) Design, manufacture, testing at manufacturer's works of 132kV Capacitor Voltage Transformers with all fittings and accessories including mounting structures as applicable.
- b) Loading at manufacturer's works, transportation and delivery at respective substation sites, including unloading at destination sites.
- c) Erection, Testing and Commissioning of Capacitor Voltage Transformers including dismantling of existing equipments
- d) The equipments covered under this specification shall be used for installation in new locations in existing sub-stations. Erection work shall be inclusive of construction of new foundation and installations including laying of cable earthing connection to the existing ground mat etc. to complete the job.
- e) It is the responsibility of the supplier/contractor to store the dismantled instrument a safe manner at a location inside the sub-station complex as directed by the site engineer of P&EDM.

5.0 132 KV, 66 KV and 33 KV Surge Arresters

The work covers :

- a) Design, manufacture, testing at manufacturer's works and of 132kV, 66kV and 33kV 10 kA Station Class heavy duty gapless metal (Zinc) oxide Surge Arrester complete with all fittings and accessories, such as surge monitor, insulating base, terminal connectors, etc. **without mounting structures.**
- b) Loading at manufacturer's works, transportation and delivery at respective substation sites, including unloading at destination sites.
- c) Erection, Testing and Commissioning of Surge Arresters including dismantling of existing equipments.
- d) Most of the equipment shall be used in replacing old and obsolete equipment in existing substations. The equipment shall be installed on existing mounting structures by retrofitting. Retrofitting also include use of earthing arrangement of existing Surge Arresters. Erection work shall be inclusive of all construction of such retrofitting including supply of any materials to complete the job and cost of dismantling of existing equipment.
- e) It is the responsibility of the supplier/contractor to store the dismantled instrument a safe manner at a location inside the sub-station complex as directed by the site engineer of P&EDM.

6.0 132 KV, 66 KV and 33 KV Isolators

The work covers :

- a) Design, manufacture, testing at manufacturer's works and of 132kV, 66kV and 33kV gang operated switch (Isolators) with all fittings and accessories including mounting structures as applicable. The Isolators are for outdoor installation suitable for horizontally mounting on mounting structures and for use at sub-stations. Isolators shall be supplied with Earth Switch as and where specified.
- b) Loading at manufacturer's works, transportation and delivery at respective substation sites, including unloading at destination sites.
- c) Erection, Testing and Commissioning of Isolators including dismantling of existing equipments.
- d) The equipment shall be used in replacing old and obsolete equipment in existing substations. Erection work shall include construction of new foundation/existing foundation, erection of mounting structure, connection to riser etc. including dismantling of existing equipments to complete the job.
- e) It is the responsibility of the supplier/contractor to store the dismantled instrument in a safe manner at a location inside the sub-station complex as directed by the site engineer of P&EDM.

6.0 132 KV, 66kV and 33 KV Control and Relay Panel

The work covers :

- a) Design, engineering, manufacture, testing & supply delivery at site, erection, testing and commissioning of Control & relay and protection panels for replacement of existing old panels. The panels should be inclusive of internal wiring and with arrangement for external connection to various Switchyard equipments and Control room building equipments as necessary. The Contractor has to design the Schematics for protection and Control of all equipments including monitoring indications, visual and audible alarm, inter-locking schemes between different equipment. Any other requirement which are not specifically covered here but which are necessary for successful commissioning of the Sub-station equipments as a whole are also within the scope of the Contract.
- b) Loading at manufacturer's works, transportation and delivery at respective substation sites, including unloading at destination sites.
- c) Erection, Testing and Commissioning of Isolators including dismantling of existing equipments.
- d) The equipment shall be used in replacing old and obsolete equipment in existing substations. Erection work shall be inclusive of construction of new foundation/existing foundation, erection of mounting structure, connection to riser etc. including dismantling of existing equipments to complete the job.
- e) It is the responsibility of the supplier/contractor to store the dismantled instrument in a safe manner at a location inside the sub-station complex as directed by the site engineer of P&EDM.

QUANTIFICATION OF WORKS

Group	Description Equipments / Items	Unit	Provisional Quantity								
			Luangmua (Aizawl)	Zuangtui (Aizawl)	Bukpui	Saitual	Bawktiang (Kolasib)	Khawiva (Lunglei)	Bairabi	Khawzaw	MIZORAM
			MZ01	MZ02	MZ03	MZ04	MZ05	MZ06	MZ07	MZ08	TOTAL
I	132kV CB (3-Pole)	Set	1	2	0	2	3	2	1	1	12
	33kV CB	Set	3	3	1	3	1	0	1	1	13
II	132kV CT (1-Ph)										
	i) 400-200-100/1-1-1A	No	6	3	0	0	9	3	3	0	24
	ii) 300-150-75/1-1-1A	No	6	6	0	0	6	6	0	0	24
	iii) 100-50-25/1-1-1A	No	0	0	0	0	0	0	3	0	3
	TOTAL	No	12	9	0	0	15	9	6	0	51
	33kV CT (1-Ph)										
	i) 600-300-150/1-1-1A	No	6	6	0	6	3	6	0	0	27
	ii) 400-200-100/1-1-1A	No	0	0	3	0	0	0	0	0	3
iii) 200-100-50/1-1-1A	No	6	0	0	0	0	15	3	0	24	
TOTAL	No	12	6	3	6	3	21	3	0	54	
III	132kV Bus PT (1-Ph)	No	9	0	0	0	3	6	0	0	18
	33kV PT (1-Ph)	No	12	12	3	3	0	6	0	0	36
	132kV line CVT (1-Ph)	No	6	9	6	6	12	3	3	6	51
IV	132kV Surge Arrestor	No	9	18	9	0	12	9	6	0	63
	33kV Surge Arrestor	No	9	15	0	6	0	3	3	0	36
V	132kV 3-Ph Isolator	Set	1	0	0	0	5	0	1	0	7
	33kV 3-Ph Isolator	Set	0	0	1	2	0	0	0	0	3
VI	Control & Relay Panels										
	(a) Line 132 kV	Nos.	2	3	0	1	4	0	0	0	10
	(b) Transformer 132 kV	Nos.	3	2	0	1	2	0	0	0	8
	(c) Line 33 kV	Nos.	6	0	2	1	0	0	0	0	9
	(d) Transformer 33 kV	Nos.	2	2	2	1	0	0	0	0	7

TENDER REQUIREMENTS FURNISHED

Sl.no.	Description	Response (Yes / No)
1.	Sales Tax/VAT Clearance / HTPC	
2.	Authorized Dealership Certificate	
3.	ISI / BIS / ISO Certificate	
4.	VAT Registration Certificate	
5.	Past experience	
6.	Whether agreed to all terms and conditions of the Contract (otherwise state conditions)	

Signature & Stamp of bidder

CONTENTS

- 1. 132kV, 66kV SF6 CIRCUIT BREAKERS**
- 2. 33kV VACUUM CIRCUIT BREAKERS**
- 3. 132kV, 66kV & 33kV CURRENT TRANSFORMERS**
- 4. 132kV, 66kV & 33kV VOLTAGE TRANSFORMERS/POTENTIAL TRANSFORMERS**
- 5. 132kV CAPACITOR VOLTAGE TRANSFORMERS**
- 6. 132kV, 66kV & 33kV SURGE ARRESTORS/LIGHTNING ARRESTORS**
- 7. 132kV, 66kV & 33kV ISOLATORS**
- 8. 132kV& 33kV CONTROL & RELAY PANELS**

**TECHNICAL SPECIFICATION
OF SF6 CIRCUIT BREAKERS FOR 132kV**

1.0. SCOPE

1.1. This specification covers :

- a) Design, manufacture, testing at manufacturer's works of 132kV SF6 Circuit Breakers with all fittings and accessories including mounting structures as applicable.
- b) Loading at manufacturer's works, transportation and delivery at respective substation sites, including unloading at destination sites.
- c) Erection, Testing and Commissioning of Circuit Breakers including dismantling of existing equipments

2.0. SERVICECONDITIONS

2.1. The plant and materials supplied shall be suitable for operation under the following climatic and other conditions:

- | | | | |
|----|----------------------------------|---|------------------------------|
| a) | Maximum ambient temperature | : | 50° C |
| b) | Minimum ambient temperature | : | 4° C |
| c) | Relative humidity | : | 35% to 98% |
| d) | Average annual rainfall. | : | 3000 mm |
| e) | No of months of tropical monsoon | : | 6 months (May to October) |
| f) | Seismic Zone | : | V |
| g) | Maximum altitude | : | Above 2210m above sea level. |

3.0. TYPE TEST REPORTS

- 3.1. Equipment, which have never been tested for critical performance, shall not be accepted. In such cases, a promise or agreement by a bidder to have the equipment tested after award of a contract is not acceptable.
- 3.2. All Bids must be accompanied by the full Type Test Certificates of equipment offered. Such type test certificates shall be acceptable only if :-
 - (a) Tests are conducted in an independent and well known testing laboratory, or
 - (b) Tests are conducted in manufacturer's own laboratory. In this case(i) the laboratory must have ISO 9000 (or its equivalent) series certification; and (ii) tests have been witnessed by technically qualified representatives of earlier clients or purchaser.
- 3.3. Test reports to be acceptable must be related directly to the materials offered. Test reports for higher class of equipment are acceptable with commitment to perform the type tests free of any charge on the particular equipment(s) after the award of contract.
- 3.4. Type Test Reports older than five (5) years on the date of bid opening shall not be accepted.

4.0. GUARANTEED TECHNICAL PARTICULARS

- 4.1 The Guaranteed Technical Particulars of the various items shall be furnished by the Bidders in the prescribed Schedules of this Section with the Technical Bid. The Bidder shall also furnish any other information's as in their opinion is needed to give full description and details to judge the item(s) offered by them.
- 4.2. The data furnished in Guaranteed Technical Particulars should be the minimum or maximum value (as per the requirement of the specification) required. A Bidder may guarantee a value more stringent than the specification requirement. However, for testing purpose or from performance point of view, the material shall be considered performed successfully if it achieves the minimum/maximum value required as per the technical specification. No preference whatsoever shall be given to the bidder offering better/more stringent values than

those required as per specification except where stated otherwise.

5.0 STANDARD

The circuit breakers shall conform to the latest revisions with amendments available at the time of testing of relevant standards, rules and codes, some of which are listed herein for ready reference. Equipment meeting with the requirements of any other authoritative standards, which ensures equals or better quality than the standards mentioned herein may also be offered. In that case, salient points of difference between the standards adopted and the specified standards shall be clearly brought out in the bid and shall be considered acceptable, if found justified after due technical evaluation.

Sl. No.	Relevant Standards	Title
1	IEC-62271-100	Specification for AC Circuit Breaker
2	IEC-376	Specification and acceptance of new supply of SF6
3	IS-2147	Degree of protection provided for enclosures for low voltage switchgear and control gear
4	IS 13118	Specification for high voltage AC Circuit Breakers
5	IS-2629	Recommended practice for hot dip galvanizing of iron and steel
6	IS-2099	High Voltage porcelain bushing
7	IS-2486	Specification for clamp connectors
8	IS-2062/2016	Specifications for GI/SS nut bolt, washer
9	IS-9135	High Voltage testing techniques
10	IS-13947	Degree of protection provided by enclosure

6.0. TECHNICAL SPECIFICATION OF CIRCUIT BREAKERS

6.1. GENERAL REQUIREMENTS

6.1.1. The circuit breakers supplied shall be complete with terminal connectors, operating mechanism, control cabinets, piping, inter-pole cable, cable accessories like glands, terminal blocks, marking ferrules, lugs, pressure gauges, density monitors (with graduated scale), galvanized support structure for C Band control cabinets, their foundation bolts and all other circuit breaker accessories required for carrying out all the functions, the CB is required to perform.

All necessary parts to provide a complete and operable circuit breaker installation such as main equipment, terminals, control parts, connectors and other devices whether specifically called for herein or not shall be provided.

6.1.2. The circuit breaker shall be of three phase unit (gang operated) (or) three identical single phase units (as said in data sheet), outdoor, single pressure puffer type. The operating mechanism shall be electrically and mechanically trip/free with anti-pumping facility suitable for remote electrical closing, tripping as well as local Operation facility as specified. The CBs are meant for installation with Transformers & Lines

6.1.3. The circuit breaker shall be so designed to withstand the effects of temperature, wind load, short circuit conditions and other adverse conditions.

6.1.4. The circuit breaker shall be capable of switching transformer magnetizing currents and shall be re strike-free.

6.1.5. All similar parts, particularly removable ones, shall be interchangeable with one another.

6.1.6. All cable ferrules, lugs, tags, etc. required for cabling from equipment control

cabinet/operating mechanism to the central control cabinet of the breaker shall be supplied loose as per approved schematics.

- 6.1.7. The SF6 breaker shall be designed to ensure that condensation of moisture is controlled by proper selection of organic insulating materials having low moisture absorbing characteristics.
- 6.1.8. The support structure of circuit breaker shall be hot dip galvanised. Sufficient galvanising thickness shall be achieved with 610gm/m². All other parts shall be painted as per painting specification enclosed separately.

6.2. OPERATING MECHANISM

- 6.2.1. A power spring operated mechanism for closing and tripping shall be provided in the breaker control cabinet (no other operating mechanism shall be accepted). This device shall be so interlocked that while it is under maintenance, the breaker cannot be operated from remote. A slow acting, manually operated device shall be provided for inspection and maintenance purposes.
- 6.2.2. In case of failure of power supply to the motor on complete close open operation shall be possible with the energy contained in the operating mechanism.
- 6.2.3. Each mechanism shall have an operation counter.
- 6.2.4. The operating mechanism shall be mounted and enclosed in a weather-proof, vermin-proof, galvanized sheet steel cabinet conforming to IP:55 degree of protection. Sheet steel thickness shall be as specified in datasheet. The cabinet shall also house relays, control and auxiliary equipment of each breaker and provision for terminating all control, alarm and auxiliary circuits. It shall be provided with hinged doors with provision for locking and removable gland plates to be drilled at site. Inspection window shall be provided for observation of the instruments without opening the cabinet. It shall be mounted so as to provide convenient access from ground level.
- 6.2.5. The cabinet shall be fitted with a thermostatically controlled anti-condensation heater, a 15A, 1 phase, 5 pin socket outlet with switch and a cubicle illuminating lamp suitable for operation on 240V AC 50Hz supply.
- 6.2.6. Circuit breakers shall feature high repeat ability of absolute closing time over a wide range of parameters (ambient temperature, pneumatic pressure, control voltages, etc).
- 6.2.7. Main poles shall operate simultaneously. There shall be no objectionable rebound and the mechanism shall not require any critical adjustment. It shall be strong, rigid, positive and fast in operation.
- 6.2.8. The design of the circuit breaker shall be such that contacts will not close automatically upon loss of gas/ air pressure.
- 6.2.9. Closing release shall be capable of operating within the range of the rated voltage as specified in the data sheet. Shunt trip shall operate satisfactorily under all operating conditions of the circuit breaker upto the rated breaking capacity of the circuit breaker within the range of the rated voltages specified in the Data sheet.
- 6.2.10. Working parts of the mechanism shall be of corrosion resisting material. Bearings which require grease shall be equipped with pressure type grease fittings. Bearing pin, bolts, nuts and other parts shall be adequately pine door locked to prevent loosening or changing adjustment with repeated operation of the breaker.
- 6.2.11. All controls, gauges, relays, valves, hard drawn copper piping and all other accessories as necessary shall be provided including the following:
- 6.2.12. Low pressure alarm and lock out relay with adjustable pressure setting suitable for operation on DC system
- 6.2.13. A no-volt relay for remote indication of power failure for Spring Charge motor.
- 6.2.14. As long as power is available to the motor, continuous sequence of closing and opening

operations shall be possible.

- 6.2.15. After failure of power supply to the motor, at least one open-close-open operation of the circuit breaker shall be possible.
- 6.2.16. Motor rating shall be such that it requires only about 30 seconds for full charging of the closing spring.
- 6.2.17. Closing action of the circuit breaker shall compress the opening spring ready for tripping.
- 6.2.18. During closing, springs are discharged and after closing of breaker, springs shall automatically be charged for the next operation. Facility for manual charging of closing springs shall be provided. Mechanical interlocks shall be provided in the operating mechanism to prevent discharging of closing springs when the breaker is already in the closed position.

6.3. OPERATING MECHANISM CONTROL

- 6.3.1. The breaker shall normally be operated by remote electrical control. Two electrically independent trip circuit including two trip coils per pole shall be provided. However, provision shall be made for local electrical control. For this purpose a local/remote selector switch, close and trip control switch/push button shall be provided in the breaker central control cabinet.
- 6.3.2. The trip coils shall be suitable for trip circuit supervision during both open and close position of the breaker. Necessary terminals shall be provided in the central control cabinet of the circuit breaker by the Supplier.
- 6.3.3. The auxiliary switch of the breaker shall be positively driven by the breaker operating rod.
- 6.3.4. A conveniently located manual tripping lever or button shall also be provided for local tripping of the breaker and simultaneously opening the reclosing circuit. A local manual closing device which can be easily operated by one man standing on the ground shall also be provided for maintenance purpose. Direction of motion of handle shall be clearly marked. Fixed ladder shall be provided for easy access of the Operating Box
- 6.3.5. When the spring get fully charged either through motor or manual device, the spring charging motor and the manual device should get disengaged mechanically from the charged spring and this should not be depended upon only the limit switch.

6.4. SF6 GAS SYSTEM

- 6.4.1. SF6 gas shall serve as an arc-quenching medium during opening/closing operation and as an insulating medium between open contacts of the circuit breaker.
- 6.4.2. The circuit breaker shall be single pressure type. The design and construction of the circuit breaker shall be such that there is a minimum possibility of gas leakage and entry of moisture. There should not be any condensation of SF6 gas on the internal insulating surfaces of the circuit breaker.
- 6.4.3. All gasketed surfaces shall be smooth, straight and reinforced, if necessary, to minimize distortion and to make a tight seal, the operating rod connecting the operating mechanism to the arc chamber (SF6 media) shall have adequate seals. The SF6 gas leakage should not exceed 0.5% per year
- 6.4.4. In the interrupter assembly there shall be an absorbing product box to minimize the effect of SF6 decomposition products and moisture. The material used in the construction of the circuit breakers shall be such as fully compatible with SF6 gas decomposition products.
- 6.4.5. Each pole shall form an enclosure filled with SF6 gas independent of two other poles and the SF6 density of each pole shall be monitored.
- 6.4.6. The dial type SF6 density monitor shall be adequately temperature compensated to model the pressure changes due to variations in ambient temperature within the body of circuit breaker as a whole. The density monitor shall have graduated scale and shall meet the

following requirements:

- It shall be possible to dismantle the density monitor for checking/replacement without draining the SF₆ gas by providing suitable interlocked non return valve coupling.

6.5. BUSHINGS AND INSULATORS

- 6.5.1. Bushings and Insulators shall be of Porcelain. Bushings shall be manufactured and tested in accordance with IS:2099 & IEC-60137, while hollow column insulators shall be manufactured and tested in accordance with IEC-62155/IS:5621. The support insulators shall be manufactured and tested as per IS:2544/IEC-60168 and IEC-60273. The insulators shall also conform to IEC-60815 as applicable
- 6.5.2. Porcelain used for the manufacture of bushings and insulators shall be homogeneous, free from defects, cavities and other flaws or imperfections that might affect the mechanical or dielectric quality and shall be thoroughly vitrified, tough and impervious to moisture.
- 6.5.3. Glazing of the porcelain shall be of uniform brown colour, free from blisters, burns and other similar defects. Bushings shall be designed to have sufficient mechanical strength and rigidity for the conditions under which they will be used. All bushings of identical ratings shall be interchangeable.
- 6.5.4. Puncture strength of bushings shall be greater than the dry flash over value. When operating at normal voltage, there shall be no electric discharge between the conductors and bushing which would cause corrosion or injury to conductors, insulators or supports by the formation of substances produced by chemical action. No radio interference shall be caused by the bushings when operating at the normal rated voltage.
- 6.5.5. Bushings shall satisfactorily withstand the insulation level specified in data sheet.

6.6. FIXED AND MOVING CONTACTS

- 6.6.1. Main contacts shall have ample area and contact pressure for carrying the rated current and the short time rated current of the breaker without excessive temperature rise which may cause pitting or welding. Contacts shall be adjustable to allow for wear, easily replaceable and shall have minimum moving parts and adjustments to accomplish these results. Main contacts shall be the first to open and the last to close so that there will be little contact burning and wear out.
- 6.6.2. Arcing contacts, if provided, shall be the first to close and the last to open and shall be easily accessible for inspection and replacement. The arcing contacts shall be made of Tungsten-Cu Alloy.
- 6.6.3. If multi-break interrupters are used, they shall be so designed and augmented that a fairly uniform voltage distribution is developed across them.

6.7. INTERLOCKS

- 6.7.1. Key release mechanical interlocks shall be incorporated in the operating mechanism for interlocking with the associated isolators, so that operation of the circuit breaker is dependent on a "key-trapped" situation. In addition, electrical interlocks with associated isolators shall be provided.

6.8. ADDITIONAL DUTY REQUIREMENTS

- 6.8.1. Circuit breakers shall be capable of clearing short line faults with the same impedance behind the bus corresponding to the rated fault current.
- 6.8.2. Circuit breakers shall be capable of breaking 25% of rated fault current at twice the rated voltage under out of phase conditions.
- 6.8.3. The Bid shall highlight the design features provided to effectively deal with:
 - a) Breaking of inductive currents and capacitive currents.
 - b) Charging of long lines and cables.

- c) Clearing developing faults within the full rating of the breaker.
- d) Opening on phase opposition.

6.9. PAINTING

- 6.9.1. Before painting all sheet steel work shall be degreased, pickled, phosphate in accordance with the IS-6005 "Code of practice for phosphating iron and sheet". Shade-697 as per IS-5 or REL-5032 or similar shades may be used for painting.
- 6.9.2. The support structure and the Control Cabinet of circuit breakers shall be hot dip galvanised. Exposed hardware items shall be hot dip galvanised or Electro-galvanised.

6.10. ACCESSORIES

6.10.1. Gas Pressure Detector

The circuit breaker shall be provided with gas pressure monitor with temperature compensation for initiating alarm and locking the operating mechanism in the event of abnormality. One common Gas pressure monitor may be provided for the three poles.

6.10.2. Position Indicator

Each pole of the circuit breaker shall be provided with a position indicator.

6.10.3. Terminals

Each circuit breaker shall be provided with suitable terminal pads of high conductivity aluminium alloy for connecting to the line.

6.10.4. Auxiliary Switches

Each circuit breaker shall be equipped with auxiliary switches with sufficient number of contacts for control, indication and interlocking purposes. Ten normally open and ten normally closed contacts shall be provided as spares. All contacts shall be rated for the DC voltage specified in data sheet.

6.10.5. Terminal Blocks

All accessories and control devices shall be completely wired. All wirings which are connected to external circuit shall be terminated on terminal blocks installed in the control cabinet. The terminal blocks provided shall have at least **25 spare terminals**.

6.10.6. Operating mechanism housing shall be supplied with all required accessories including the following:

- a) Padlocks and duplicate keys.
- b) Space heaters equipped with automatic thermostatic control.
- c) Local/remote change over switch (with two pairs of NO/NC contacts for Purchaser use).
- d) Manually operated tripping push button/lever (mechanical) conveniently located to trip all three phases simultaneously.
- e) Control switches to cut off control power supplies.
- f) Fuses as required.
- g) Two earthing terminals.
- h) Auxiliary relays required for satisfactory operation.
- i) Motor contactor with thermal release
- j) Provision of mechanical interlock with isolator

6.11. EQUIPMENT FOUNDATION AND STEEL STRUCTURE :

- a) The Circuit breaker etc. shall be furnished complete with base frame, anchor/foundation bolts and hardware. Details structure assembly drawing, mentioning part no. of each member and also indicating cross sectional area of member used with supporting calculations. The point of C.B., dynamic load and its amplitude, dead load etc. shall be mentioned.

- b) The successful tenderers shall furnish necessary foundation/anchor details with designed loads within 30 (thirty) days from the date of issue of letter of intent/purchase order.
- c) Similar grounding pad as mentioned against Sl.No.9 are also to be provided.
- d) If the Centre line of Control Cubicle is more than 1.50m above ground plate, one suitable platform with checker plate shall be fixed at a suitable height of support structure with ladder step arrangement, to access the control cubicle for Local operation & maintenance purpose.

6.12. NAME PLATES

6.12.1. All equipment shall have non-corrosive name plates fix at a suitable position indelibly mark with the following particular there on in accordance with the standard adapted.

- i. Rated voltage/Maximum voltage
- ii. Rated insulation level
- iii. Type/Model No./Sl.No./Year of manufacture.
- iv. Rated current v. Rated frequency.
- vi. Rated short Circuit Breaking Current.
- vii. Rated transient recovery voltage for terminal fault.
- viii. Rated short circuit making current.
- ix. Rated operating sequence.
- x. Rated short time current.
- xi. Rated line charging/breaking current
- xii. Rated Cable charging current.
- xiii. Rated single capacitor bank charging/breaking current.
- xiv. Rated small inductive breaking current.
- xv. Rated Supply Voltage of auxiliary circuits.
- xvi. Applicable standard.
- xvii) Property Label: P&E Department, Mizoram
- xviii) Purchase Order no. & date.

6.13. EARTHING

6.13.1. Two earthing pads shall be provided on each supporting structure. Each control cabinet or terminal box mounted on the supporting structure shall also be connected to an earthing pad. Separately mounted control cabinets shall be provided with two earthing pads adjacent to the base of the cabinet. The earthing connection shall be bolted type and suitable for receiving 65mmx12mmMS strip.

6.14. TERMINAL CONNECTORS

6.14.1. The equipment shall be supplied with required number of terminal connectors of approved type suitable for twin ACSR Panther conductor. However, the type of terminal connector, size of connector, material, and type of installation shall be approved by the Purchaser, as per installation requirement while approving the equipment drawings.

6.15. TESTS

6.15.1. Routine Tests

All routine tests as applicable shall be carried out in accordance with relevant IS/IEC. All routine/acceptance tests shall be witnessed by the Purchaser/his authorized representative.

6.15.2. Test Certificates

Copies of routine/acceptance test certificates shall be produced with the endorsement of the

inspecting authority to the Purchaser before effecting dispatch for approval and for issuing dispatch clearance. The test report shall contain the following information:

- (i) Complete identification data, including serial No. of the breaker.
- (ii) Method of application, where applied, duration and interpretation of results in each test.

6.15.3.Type Tests:

The bidder must furnish type test certificates of all mandatory Type Tests (as per IEC62271-100) along with the bid for breaker of identical design.

In the event of order, the successful bidder may also be asked to refurnish the Type Test Reports for review and record of the Purchaser.

6.16. SPECIAL TOOLS AND TACKLES

6.16.1. The Bidder shall furnish a list of any special tools and tackles required for maintenance and operation purposes with recommended quantities for each substation.

7.0 TENDER DRAWING, MANUALS AND TYPE TEST CERTIFICATES : The following drawings and manuals shall be furnished for information purpose with each copy of the tender.

7.1 General Arrangement Drawings indicating all dimensions, electrical clearness and distance of each piece of Equipment showing constructional features and dispositions of various fittings and accessories and also static dead load at point of application.

7.2 Technical leaflets/manuals on each piece of Equipment explaining the function of various parts, principle of operation and special features. Technical leaflets/manuals for offered type of vacuum bottle etc.

7.3 Type Test Certificates as per IEC/relevant IS carried out on Similar Breaker from reputed/recognised laboratory shall be furnished.

8. CONTRACT DRAWING AND CATALOGUE : After placement of order, two (2) copies of various drawings data and manuals in hard copies and soft copy of pdf/dwg format as mentioned below shall be submitted to the purchaser for approval.

8.1 Dimensional General Arrangement drawing showing all dimensions and disposition of fittings and space requirement and mounting arrangements.

8.2 Sectional views of contact assembly, operating mechanism and are extinguishing chamber.

8.3 Transport/shipping dimensions with weights.

8.4 Foundation and anchor details including dead-load and impact load with direction and also point of application.

8.5 Assembly drawing for erection at site with part numbers and schedule of materials.

8.6 Electrical schematic and wiring diagram with explanatory notes, if any.

8.7 Schematic diagram for spring charged operating mechanism schematic layout drawings.

8.8 Name plate drawing and any other relevant drawing and data necessary for erection, operation and maintenance.

8.9 Outline drawings of bushings, terminals and terminal connectors.

8.10 After approval, the supplier shall submit Instruction manuals and data sheets for each rating of Equipment. The manuals shall clearly indicate the installation methods, checkups and tests to be carried out for testing the Equipment and maintenance procedure.

6.17. TECHNICAL DATA SHEET FOR CIRCUIT BREAKER

Sl. No.	Particulars	Unit	Data for 132 kV CB
1	Type		SF6
2	No of poles		3 (3 Phase Ganged Unit)
3	Service		Outdoor
4	Rated System Voltage	kV	132
5	Highest System Voltage	kV	145
6	System earthing		Solidly earthed system
7	Rated Voltage of Breaker	kV	145
8	Rated Continuous Current	Amps	1250
9	Rated Frequency	Hz	50
10	Rated Short Circuit breaking current(I)	kA RMS	31.5
11	Rated Short Circuit making current	kA PEAK	2.5*I
12	Duty cycle		0-0.3Sec- CO-3Min- CO
13	First pole to clear factor		1.3
14	Operating time		
	i) Opening Time	ms	Not exceeding 50ms
	ii) Closing Time	ms	Not exceeding 120ms
15	Insulation level		
	i) Power Frequency withstand Voltage	kVRMS	275
	ii) Impulse withstand Voltage	kVPeak	650
16	Minimum Clearance between phases	mm	1300
17	Minimum clearance between phase to earth	mm	1300
18	(i) Minimum Ground clearance (from bottom most live part to plinth level)	mm	5000
19	Minimum clearance from bottom of support insulator to plinth level	mm	2500
20	i) Minimum Creepage Distance (Total)	mm	3625
	(i) Minimum Creepage distance (protected)	Mm	1813
21	Operating Mechanism		Spring Charged
	a) Type		
	b) Type & Rated Voltage for Drive Motor	V	110V, DCVolts Universal
	c) Rated voltage of Shunt trip coil & operating range	V.DC	110 [50%- 110%]
	d) Rated voltage of Closing coil & operating range	V.DC	110[80%-110%]
	e) No. of trip coils	No	2 per CB
	f) No. of closing coils	No	1 per CB
	g) No of spare auxiliary contacts & contact rating	Nos AMPS	10N/O+10N/C (per CB) 10A at 240VAC & 2A at 110VDC
	h) Minimum thickness of sheet steel for control cabinet	mm	3
i) Enclosure Protection		IP55	
22	Reclosing		Three Phase auto reclosing

23	Support structure & Control Cabinet		Galvanised
24	All other parts (Painted/ Galvanised)		Synthetic enamel shade 631 of IS5 (125microns/50 microns minimum in case of powder coating)
25	Minimum size of control wiring (Copper)	Sq.mm	2.5

6.0. ERECTION, TESTING AND COMMISSIONING

- 6.1 Bidders should note that, the equipment covered in this specification shall be used in replacing old and obsolete equipment in existing substations. Prices quoted for erection shall be inclusive of cost of new foundation, erection of mounting structure, connection to riser etc. including dismantling of existing equipments etc.
- 6.2 It is responsibility of Supplier/Contractor to store the dismantled Circuit breakers in a safe manner at a location inside the substation complex as directed by the site Engineer of P&EDM.
- 6.3 As the most of the equipment shall be used for replacement of existing old equipment, shutdown of the system may require. In view of this, the contractor shall give their substation/equipment wise erection, testing and commissioning schedules at least **15(fifteen)** days ahead.

**TECHNICAL SPECIFICATION
OF 33kV CIRCUIT BREAKERS**

1.0 SCOPE :

- 1.1 This Specifications intended to cover the design, manufacture, assembly and Testing at manufacturer's works of 33 KV, 3 Ph., 50 C/S, 1250A, 25KA, Outdoor Type Porcelain Clad, Vacuum Circuit Breaker for efficient and trouble-free operation as specified hereunder.
- 1.2 The Circuit Breakers are required complete with structures, operating mechanism and all associated accessories and auxiliaries.

2. STANDARDS :

The circuit breakers shall conform to the latest revisions with amendments available at the time of testing of relevant standards, rules and codes, some of which are listed herein for ready reference. Equipment meeting with the requirements of any other authoritative standards, which ensures equals or better quality than the standards mentioned herein may also be offered. In that case, salient points of difference between the standards adopted and the specified standards shall be clearly brought out in the bid and shall be considered acceptable, if found justified after due technical evaluation.

Sl. No.	Relevant Standards	Title
1	IEC-62271-100	Specification for AC Circuit Breaker
2	IS-2147	Degree of protection provided for enclosures for low voltage switchgear and control gear
3	IS 13118	Specification for high voltage AC Circuit Breakers
4	IS-2629	Recommended practice for hot dip galvanizing of iron and steel
5	IS-2099	High Voltage porcelain bushing
6	IS-2486	Specification for clamp connectors
7	IS-2062/2016	Specifications for GI/SS nut bolt, washer
8	IS-9135	High Voltage testing techniques
9	IS-13947	Degree of protection provided by enclosure

3. **DEVIATION :** Normally the offer should be as per Technical Specification without any deviation. But any deviation felt necessary to improve performance, efficiency and utility of Equipment must be mentioned in the "Deviation Schedule" with reasons of such deviation. Such deviation suggested may not be accepted. Deviations not mentioned in Deviation Schedule will never be considered.

4. GENERAL INFORMATION :

- 4.1 The Circuit Breakers specified herein are to be normally installed anywhere in Mizoram.
- 4.2 The General Weather Conditions are stated below.
- Climate condition : The area is Tropical with monsoon from May to October, about 2210 mm annual rainfall.
 - Number of Thunderstorm days : 75 days.
 - Ambient Temp. : 50°C (max) and 4°C (min.).
 - Maximum Wind Pressure : 150 Kg. Per Mtr. Sq.
 - The site falls within seismic zones- V

- 4.3 The Equipment offered shall be suitable for heavily polluted atmosphere.
- 4.4 The Equipment to be furnished under this Specification shall be packed for shipment so as to meet the weight and space limitations of transport facilities, specifically along with Rail, Road, right of way.
- 4.5 The Equipment covered by this Specification shall be complete in all respects. Any material or accessory which may not have been specifically mentioned, but is essential or necessary for satisfactory and trouble free operation and maintenance of the Equipment shall be furnished without any extra charge to the purchaser.
- 4.6 The Equipment shall be supplied with all accessories listed in this Specification with such modifications and alternations as to safeguard the Technical requirements.

5. DESIGN CRITERIA :

- 5.1 The Equipment will be used in non effectively neutral grounded System with fault level of 20 KA at highest system voltage of 36 KV.
- 5.2 Continuous current rating shall be 1250 Amp. Maximum temperature attained by any part of the Equipment at specified rating should not exceed the permissible limit as stipulate in the relevant standards. Equipment shall be designed taking 50 0C as maximum ambient temperature.
- 5.3 The circuit breakers and their components shall be capable of withstanding the mechanical forces and thermal stresses of the short circuit current of the system without any damage or deterioration of material.
- 5.4 The circuit breakers shall have motor wound spring charged trip free mechanism with anti pumping feature, and shunt trip. In addition, facility for manual charging of spring, shall be provided.
- 5.5 Each breaker shall be provided with manual close & open facility, mechanical ON-OFF indication, an operation counter and mechanism charge/discharge indicator.
- 5.6 For motor wound mechanism, spring charging shall take place automatically after each breaker closing operation. One open-close-open operation of the circuit breaker shall be possible after failure of power supply to the motor. A visual mechanical indicating device will also be provided to show the position of the spring.
- 5.7 All controls shall be suitable for 80%, to 110% for closing & 70% to 110% for tripping of 30V D.C. The A.C. supply shall be available 400 Volt +/- 10%, 50 Hz. 3 phase 4 wire system.
- 5.8 The operating duty of the Breaker will be 0-0.3 sec-CO-3 min-CO.
- 5.9 There shall be no radio interference when the Equipment is operated upto maximum service voltage.
- 5.10 The minimum safe clearance of all live parts of the Equipment shall be as per relevant standards. Clearances of 33 KV Low Level pipe bus of our switchyard are : a) Phase to Phase : 1200 mm and b) Pipe bus to ground level of supporting structure : 4000 mm Please note that usually our plinth height is 300 mm.

- 5.11 All electrical and mechanical interlocks which are necessary for safe and satisfactory operation of the Breaker shall be furnished. The interlocking device shall be of proven quality.
- 5.12 The condition of Breaker and its contacts shall be intact even under conditions of phase opposition that may arise due to faulty synchronisation or otherwise. Tenderers should confirm in this regards.
- 5.13 The Breaker shall be capable of smooth and rapid interruption of current under all conditions, completely suppressing the undesirable phenomenon even under the most severe and persistent rated short circuit conditions. There will be no abnormal voltage rise subsequent to the switching ON/OFF a capacitor bank within the rated capacity.
- 5.14 The total make and break time (in m sec/cycle) for the breaker throughout the range of their operating duty shall be indicated and guaranteed.
- 5.15 The breaker shall be suitable for interrupting low inductive currents without generation of abnormal over voltage.
- 5.16 The breaker shall be capable of interrupting rated breaking current with recovery voltage equal to maximum line Service Voltage and at all inductive power factor of the Circuit equal to or exceeding 0.15.
- 5.17 The Circuit Breaker shall be capable to withstand power frequency over Voltage 70 KV for 1 sec.
- 5.18 The tenderer may indicate in his offer the methods adopted for limiting over voltage.
- 5.19 The Circuit Breaker with its galvanized steel structure shall be suitable for mounting on concrete foundation. The height of the supporting structure will be such that it will be able to maintain clearance as indicated in clause 5.10 above.
- 5.20 The detail of steel structure, foundation design and erection drawing shall be given. In GA/Structure drawing please indicate the location of CB., point of application of dynamic load and its amplitude, dead load etc.
- 5.21 Special tools & tackles required for erection and dismantling and fitting of the Breaker and its accessories, if required shall be offered indicating the prices etc.
6. **CONSTRUCTION** : Each vacuum Circuit breaker shall comprise of three identical poles linked together electrically and mechanically for synchronous operation.
- Vacuum Interrupter** The vacuum interrupter, consisting of fixed contact and moving contact, shall be interchangeable among the same type interrupter. Short circuit capacity of vacuum bottle should be 25 KA and design life should be 100 nos. operation at rated short circuit level.
- i) Constructional features of the vacuum chamber along with its functional arrangements are to be shown in a drawing submitted along with tender documents.
 - ii) The gap between contacts of the Circuit Breaker inside interrupter should be capable of withstanding 1.5 time voltage to neutral at one atmospheric pressure at normal ambient condition within Breaker in the event of vacuum pressure drop due to leakage.

- iii) Vacuum Bottle shall be of Siemens/ABB/ALSTOM/CGL/BEL/reputed indigenous make. Offered bottle shall be identical with Type tested one. Brochures/leaflet on technical data sheet for vacuum bottle shall be enclosed with technical bid.

6.1 MAIN CONTACTS :

- a) In vacuum interrupter the contact configuration, contact area, contact pressure will be sufficient for carrying rated current and short time rates current, without any abnormal phenomena.
 - b) Complete details of main contacts shall be furnished. The material of contacts and coating of the contacts shall be suitable for vacuum Breaker technology. Evaporation of metal during arcing and deposition of the same in the inner surface of vacuum interrupter should be restricted by adopting suitable material. Tenderer shall furnish the justification of using the materials for contacts.
 - c) Complete details of main contacts and arc quenching device, if any with sectional drawings shall be furnished at the time of offer. Measures taken to free the contacts from vibration during closing shall be clearly explained in the drawing, support by tests results.
 - d) The contact erosion should be limited upto 3 mm for useful life and indication to monitor the progress of contact erosion has to be provided.
- 6.2 The vacuum pressure within interrupter shall be adequate to interrupt the fault current. Precaution shall be taken so that there will be no flush over on outside of the vacuum interrupter inside the porcelain insulator.
- 6.3 Design of the vacuum bottle and its insulator encasing should be suitable for outdoor use, taking care of required creepage distance considering possibility of moisture condensation if any, in the annular space between the vacuum bottle and insulator enclosure. Type test with identical bottle type with similar encasing arrangement shall be done and accordingly Report shall be submitted along with tender document.
- 6.4 Vacuum bottle with its insulator encasing chamber shall be hermetically sealed. Free passage of air in the chamber with or without provision of circulation of hot air is not accepted. 6.5 Tripping/Closing Coil burden of Equipment should not be more than 200 watts at 30 V D.C. The value will not be relaxed, specially for tripping coil.

6.5 OPERATING MECHANISM :

- a) The operating mechanism shall be suitable for rapid closing and tripping. The opening and closing energy shall be obtained from spring charge mechanism. The spring charging may be done by either motor operation with facility for manual charging when required or by other suitable trouble free mechanism. Local arrangement for operating breakers both electrically and mechanically shall be provided in addition to remote operation.
- b) The mechanism shall have anti pumping circuitry and will be trip free electrically and mechanically. The antipumping arrangement shall be initiated through normally “NO” type, direct auxiliary contact of circuit breaker and shall be of self hold type. Plug-in type relay/Contactor for Antipumping Relay will not be acceptable.
- c) Spring operated mechanism will be complete with opening spring, closing spring, limit switch and all necessary accessories to make the mechanism a complete operating unit.
- d) Contactor used for antipumping relay shall be of reputed make.
- e) There shall be mechanical ON/OFF indicator spring charge and operation counter for each Breaker and also provision for remote indication.
- f) The operating mechanism box shall be fixed at a working height from ground level. View glass shall be provided on hinged door at the front side.
- g) Spring charging LS shall have sufficient no. of spare contact.

6.6 COMMON CONTROL CUBICLE :

- a) A free standing outdoor type weather proof, dust and vermin proof cubicle shall be provided to house the operating mechanism and all other accessories except those which must be located in the pole box.
- b) The cubicle shall be of 3.00 mm thick sheet steel and shall have hinged doors at front and hinged/bolted door or cover at rear for access to the mechanism. Doors should be of proper design for smooth opening and closing with pad locking arrangement. Double door at front size is preferable.
- c) A removable gland plate of 3 mm thickness shall be provided at the bottom of the cubicles for purchasers Cable entry. Glands of sizes suitable for entry of 1 no. 12 core, 2 nos. 8 core and 2 nos. 4 core Cables for Control etc.
- d) Terminal blocks for AC & DC shall be kept separate. Terminals shall be stud type and suitable for at least 2x2.5 sq.mm copper leads. All wiring shall be of 1100 V grade PVC. At least 15% spare terminal shall be provided in the Terminal blocks.
- e) Thermostat controlled heaters shall be provided to prevent condensation within cubicle. Cubicle illumination Lamp with switch and a 230 V., 15A, 3 pin socket with a Control Switch shall be provided.
- f) All controls, alarms, indications and interlocking devices furnished with breaker shall be wired up to the terminal Block in the common control cubicle. Not more than two wires shall be connected to one terminal.
- g) All wires shall be identified at both ends with ferrule marking in accordance with approved wiring diagram.
- h) Way terminals with bonding screws and washers. At least 15% spare terminal shall be provided.
- i) Scheme diagram on a durable sticker shall be fixed on inside door of Control Cubicle.
- j) Degree of protection of control cubicle shall be IP-55.
- k) ONE NO CLOSING COIL AND ONE NO TRIPPING COIL IN ADDITION TO NORMAL 1 NO CLOSING COIL AND 2 NOS TRIPPING COIL SHALL BE PACKED AND PUT SEPARATELY & CAREFULLY INSIDE THE COMMON CUBICLE. THIS IS TO BE DELIVERED ALONG WITH EACH BREAKER. NO SEPARATE PRICE SHALL BE PAID EXTRA.

7. INSULATORS :

- a) Porcelain supports, interrupter housing of adequate mechanical and dielectric strength with suitable creepage distance shall have to be used. All Support/Interrupter Housing of identical ratings shall be interchangeable. Each Interrupter-Housing shall be provided with terminal stud/pad.
- b) The porcelain used in interrupter housing shall be made from wet process and shall be homogeneous, free from laminations, caustics and other flaws which may impair its mechanical or dielectric strength and shall be glossy, tough and impervious to moisture.
- c) The porcelain supports, interrupter –housing insulation shall be coordinated with that of Circuit Breaker. The puncture strength of the bushings shall be greater than the dry flashover value.
- d) When operating at rated voltage, there shall not be any electrical discharge between live terminal and earth. No Radio disturbance shall be caused by the support insulators when operating up to the maximum System Voltage. It shall also be free from corona.
- e) All iron parts shall be hot dip galvanised. The nuts, bolts, washers etc. shall also be hot dip galvanised steel or stainless steel.
- f) Each Circuit Breaker shall be provided with Bi-metallic terminal stud/pad suitable for connection of pipe bus/ACSR Conductor.

8. AUXILIARY CONTACTS :

- a) Breaker shall be provided with 6 NO & 6 NC spare auxiliary contacts in addition to the auxiliary contacts required for Breaker's own operational requirements. These auxiliary contacts shall preferably be convertible type.
- b) These contacts shall have continuous current rating of at least 10A. The breaking capacity shall be adequate for the circuits controlled, or at least 12A at 30 V DC with a circuit time constant of minimum 20 ms.
- c) All these contacts shall be wired up to terminal block in the control cubicle. Auxiliary contacts which are to be installed on the frame of Circuit Breaker shall be suitably protected against accidental arcing from main circuit. Insulating materials of contacts shall be ceramics or other non-tracking materials.

9. GROUNDING : Circuit Breaker shall be provided with two grounding pads with 2 nos. tapped holes for M10 bolts and spring washers for connection of purchaser's grounding conductor (50x6 mm G.I. strips).

10. PAINTING : External surfaces shall be given a coat of high quality red oxide or other suitable primer and shall be finished with two coats of synthetic enamel paints of shade 631 of I.S.S. Such painting should be able to withstand tropical climate as stipulated in Sl.No.4 of this Specification.

11. EQUIPMENT FOUNDATION AND STEEL STRUCTURE :

- a) The Circuit breaker etc. shall be furnished complete with base frame, anchor/foundation bolts and hardware. Details structure assembly drawing, mentioning part no. of each member and also indicating cross sectional area of member used with supporting calculations. The point of C.B., dynamic load and its amplitude, dead load etc. shall be mentioned.
- b) The successful tenderers shall furnish necessary foundation/anchor details with designed loads within 30 (thirty) days from the date of issue of letter of intent/purchase order.
- c) Similar grounding pad as mentioned against Sl.No.9 are also to be provided.
- d) If the Centre line of Control Cubicle is more than 1.50m above ground plate, one suitable platform with checker plate shall be fixed at a suitable height of support structure with ladder step arrangement, to access the control cubicle for Local operation & maintenance purpose.

12. TENDER DRAWING, MANUALS AND TYPE TEST CERTIFICATES : The following drawings and manuals shall be furnished for information purpose with each copy of the tender.

- 12.1 General Arrangement Drawings indicating all dimensions, electrical clearness and distance of each piece of Equipment showing constructional features and dispositions of various fittings and accessories and also static dead load at point of application.
- 12.2 Technical leaflets/manuals on each piece of Equipment explaining the function of various parts, principle of operation and special features. Technical leaflets/manuals for offered type of vacuum bottle etc.
- 12.3 Type Test Certificates as per IEC/relevant IS carried out on Similar Breaker from reputed/recognised laboratory shall be furnished.

13. CONTRACT DRAWING AND CATALOGUE : After placement of order, two (2) copies of various drawings data and manuals in hard copies and soft copy of pdf/dwg format as mentioned below shall be submitted to the purchaser for approval.

- 13.1 Dimensional General Arrangement drawing showing all dimensions and disposition of fittings and space requirement and mounting arrangements.
- 13.2 Sectional views of contact assembly, operating mechanism and arc extinguishing chamber.
- 13.3 Transport/shipping dimensions with weights.

- 13.4 Foundation and anchor details including dead-load and impact load with direction and also point of application.
- 13.5 Assembly drawing for erection at site with part numbers and schedule of materials.
- 13.6 Electrical schematic and wiring diagram with explanatory notes, if any.
- 13.7 Schematic diagram for spring charged operating mechanism schematic layout drawings.
- 13.8 Name plate drawing and any other relevant drawing and data necessary for erection, operation and maintenance.
- 13.9 Outline drawings of bushings, terminals and terminal connectors.
- 13.10 After approval, the supplier shall submit Instruction manuals and data sheets for each rating of Equipment. The manuals shall clearly indicate the installation methods, checkups and tests to be carried out for testing the Equipment and maintenance procedure.

14. TEST REPORTS AND TYPE TESTS : The bidder shall submit detailed as well as complete test reports of all tests (including Type Test) as stipulated in relevant IS and IEC with Complete identification, date and serial no., carried out in a Government recognized Test House or Laboratory/ CPRI/ NABL accredited lab/ on Circuit Breakers of identical design.

COPIES OF FOLLOWING TYPE TEST REPORT AS PER LATEST IS/IEC, CARRIED OUT WITHIN FIVE (5) YEARS, FROM THE DATE OF NIT PUBLICATION, FROM CPRI, NABL ACCREDITED/A GOVERNMENT RECOGNISED TEST HOUSE OR LABORATORY SHALL BE SUBMITTED ALONG WITH TENDER DOCUMENTS AS PRE- REQUISITES. FAILING WHICH THEIR OFFER MAY NOT BE TECHNICALLY ACCEPTABLE.

- a) Single capacitor bank breaking test
- b) Short time withstand and peak withstand current test
- c) Lightning impulse voltage withstand test
- d) Temperature rise Test
- e) Mechanical Endurance

15. SPECIFIC LIMIT OF AUXILIARY SUPPLY VOLTAGE :

- i) The auxiliary supply voltage shall be 85% to 110% of the rated 30 V in supply for closing coil and the same shall be 70% to 110% for tripping coil.
- ii) The operating voltage for motor operated spring charged mechanism shall be 400V A.C., 3 phase, 50 Hz or 230V. 1-phase, 50 Hz. The motor shall operate at a voltage variation of 85% to 110% of the supply voltage.

16. NAME PLATE :

- i. Rated voltage/Maximum voltage
- ii. Rated insulation level
- iii. Type/Model No./Sl.No./Year of manufacture.
- iv. Rated current v. Rated frequency.
- vi. Rated short Circuit Breaking Current.
- vii. Rated transient recovery voltage for terminal fault.
- viii. Rated short circuit making current.
- ix. Rated operating sequence.
- x. Rated short time current.
- xi. Rated line charging/breaking current
- xii. Rated Cable charging current.
- xiii. Rated single capacitor bank charging/breaking current.
- xiv. Rated small inductive breaking current.
- xv. Rated Supply Voltage of auxiliary circuits.
- xvi. Applicable standard.
- xvii) Property Label: P&E Department, Mizoram
- xviii) Purchase Order no. & date.

17. ACCESSORIES : Each Breaker shall be furnished complete with fittings and accessories as listed below (The list is illustrative & not exhaustive).

- i. Clamp-type terminal connectors for ACSR Conductor
- ii. Base frame and foundation/anchor bolts.
- iii. Operating mechanism, trip and close coils.
- iv. Auxiliary Contacts and Relays/Contacts.
- v. Local/Remote selector Switch and Close/Trip Control Switch.
- vi. Manual close and trip devices.
- vii. Mechanical ON/OFF indicators.
- viii. Operation counter.
- ix. Weatherproof Control cubicle and operating mechanism boxes, with locking arrangement.
- x. Set of Switch-Fuse/MCB/MCCB units for A.C. & D.C. Supply.
- xi. Space heaters with thermostat and switch.
- xii. Cubicle illumination Lamp with Switch.
- xiii. Terminal blocks and internal wiring.
- xiv. G.I. conduits and accessories for connection between Central Control Cubicle and operating mechanism boxes where applicable.
- xv. Other standard accessories which are not specified, but are necessary for efficient and trouble free operation shall be supplied.

18. TEST AT FACTORY AND TEST CERTIFICATES

18.1 All Acceptance tests may be carried out at manufacturer's works in the presence of the P&E Department and Contractors representatives. In addition to the above, all routine tests are also to be carried on the breakers as per relevant IS. The entire cost of acceptance and routine test that to be carried out as per relevant IS shall be treated as included in the quoted price of breakers. The contractor shall give at least 21(twenty one) days advance notice intimating the actual date of inspection and details of all tests that are to be carried out from the date when the tests will be carried out.

18.2 Routine tests on all breakers shall be carried out as per IEC-56 or IS-13118 and test reports shall be submitted along with respective inspection offer to the purchaser.

19. TYPE TESTS after issuance of order: Besides submission of Type test Report, carried out within five years as per tender specification, Type Test at the discretion of Ordering authority, shall have to be arranged by the successful contractor from any lot offered for inspection, sample chosen at random after successful routine test by our inspection team, as per relevant ISS from CPRI/ NABL accredited/ Government recognized Test House or Laboratory in the presence of P&E Department representative. However the necessary cost of the type test Charges will be reimbursed to the party on production of necessary supporting documents.

20 ERECTION, TESTING AND COMMISSIONING

20.1 Bidders should note that, the equipment covered in this specification shall be used in replacing old and obsolete equipment in existing substations. Prices quoted for erection shall be inclusive of cost of new foundation, erection of mounting structure, connection to riser etc. including dismantling of existing equipments etc.

20.2 It is responsibility of Supplier/Contractor to store the dismantled Circuit breakers in a safe manner at a location inside the substation complex as directed by the site Engineer of P&EDM.

20.3 As the most of the equipment shall be used for replacement of existing old equipment, shutdown of the system may require. In view of this, the contractor shall give their substation/equipment wise erection, testing and commissioning schedules at least **15(fifteen)** days ahead.

REQUIRED TECHNICAL PARAMETERS

Sl.No.	Description	33 KV
1	Service	Outdoor
2	Class of breaker	C1-M2
3	Type	Vacuum
4	Design life to withstand rated short circuit level	100 nos operation
5	Rated frequency (Hz)	50
6	i) Normal System Voltage (KV)	33
	ii) Rated Voltage (KV)	36
7	i) Effectively earthed (EE)	NA
	ii) Non-effectively earthed (NEE)	NE Earthed through grounding Transformer
8	Insulation level (KVp)	
	i) 1.2/50 micro second impulse withstand voltage	170
	ii) Maxm. Permissible Switching over Voltage	112
	iii) 1 minute power frequency withstand Voltage (KV rms)	70
9	Rated Current (Amps)	
	i) Continuous	1250
	ii) Short time rating for 3 sec in KA	25
10	Creepage distance (mm)	900
11	Breaking time (m. sec.)	Not exceeding 60
12	Closing time (m. sec)	Not exceeding 130
13	Rated line charging/breaking Current (Amps)	10
14	Rated Cable charging/breaking Current (Amps.)	50
15	Rated single capacitive making/breaking Current (Amps.) without switching over Voltage exceeding 2.3 p.u.	50
16	Rated small inductive making/breaking Current (Amps.) without switching over Voltage exceeding 2.3 p.u.	Equivalent to magn current of 10MVA & 6.3 MVA Transformer, as applicable
17	Rated operating sequence (0-Opening, C-Closing)	0-0.3sec.-CO-3min-CO
18	Operating mechanism	Spring Charged
19	No. of trip coils	Two nos. Common for 3 pole, each having the capacity to trip all three pole successfully.
20	Trip coil and closing coil voltage (DC Volt)	30
21	Phase to Phase clearance of pipe bus (mm)	1200
22	Minimum clearance of live parts In air and ground (mm)	3700
23	First pole to clear factor	1.5
24	Altitude above mean sea level (meter)	Not exceeding 1000
25	Terminal connectors suitable for ACSR conductor/ Aluminium pipe	Panther/Dog/1.5" Al pipe
26	Supply Voltage for operating device	400 Volt, 3 phase 50 Hz or 230 V, 1 phase, 50 Hz
27	Power requirement for Tripping and closing coil	Maximum 200 W at 30Volt

TECHNICAL SPECIFICATION
OF 132kV and 33 kV Current Transformer

1.0. SCOPE

1.1. This specification covers :

- a) Design, manufacture, testing at manufacturer's works of 132kV and 33kV Current Transformer with all fittings and accessories excluding mounting structures as applicable.
- b) Loading at manufacturer's works, transportation and delivery at respective substation sites, including unloading at destination sites.
- c) Erection, Testing and Commissioning of Current Transformers including dismantling of existing equipments.

2.0. SERVICE CONDITIONS

2.1. The plant and materials supplied shall be suitable for operation under the following climatic and other conditions:

- | | | | |
|----|----------------------------------|---|------------------------------|
| a) | Maximum ambient temperature | : | 50° C |
| b) | Minimum ambient temperature | : | 4° C |
| c) | Relative humidity | : | 35% to 98% |
| d) | Average annual rainfall. | : | 3000 mm |
| e) | No of months of tropical monsoon | : | 6 months (May to Oct) |
| f) | Seismic Zone | : | V |
| g) | Maximum altitude level. | : | Above 2210m above sea level. |

3.0. TYPE TEST REPORTS

- 3.1. Equipment, which have never been tested for critical performance, shall not be accepted. In such cases, a promise or agreement by a bidder to have the equipment tested after award of a contract is not acceptable.
- 3.2. All Bids must be accompanied by the full Type Test Certificates of equipment offered. Such type test certificates shall be acceptable only if:-
 - (a) Tests are conducted in an independent and well known testing laboratory, or
 - (b) Tests are conducted in manufacturer's own laboratory. In this case(i) the laboratory must have ISO9000 (or its equivalent) series certification; and (ii) tests have been witnessed by technically qualified representatives of earlier clients or purchaser.
- 3.3. Test reports to be acceptable must be related directly to the materials offered. Test reports for higher class of equipment are acceptable with commitment to perform the type tests free of any charge on the particular equipment(s) after the award of contract.
- 3.4. Type Test Reports older than five(5) years on the date of bid opening shall not be accepted.

4.0. GUARANTEED TECHNICAL PARTICULARS

- 4.1. The Guaranteed Technical Particulars of the various items shall be furnished by the Bidders in the prescribed Schedules of this Section with the Bid. The Bidder shall also furnish any other information's as in their opinion is needed to give full description and details to judge the item(s) offered by them.

- 4.2. The data furnished in Guaranteed Technical Particulars should be the minimum or maximum value (as per the requirement of the specification) required. A Bidder may guarantee a value more stringent than the specification requirement. However, for testing purpose or from performance point of view, the material shall be considered performed successfully if it achieves the minimum/maximum value required as per the technical specification. No preference whatsoever shall be given to the bidder offering better/more stringent values than those required as per specification except where stated other wise.

5.0. STANDARDS :

The items shall conform in all respects to the following relevant standards/regulations with latest amendments thereof:

S. No.	Relevant Standards	Title
1.0	IS 2705 (Part I to IV)	Current transformers
2.0	IS 4201	Application guide for current transformers.
3.0	IS 2099	High voltage porcelain bushings
4.0	IS 11322	Partial discharge measurement in instrument transformer
5.0	IS 2071	Methods of high voltage testing
6.0	IS 335	Insulating oil
7.0	IS 60529	Degree of protection provided by enclosures for low voltage switchgear and control
8.0	IEC 60044 - 1	Current transformers
9.0	IS 5561	Electric power connections – terminal connectors
10.0	IS 4759	Hot dip zinc coatings on structural steel and other allied products
11.0	IS 2633	Methods of testing weight, thickness and uniformity of coating on hot dipped galvanised articles
12.0	IS 13134/IEC 60815	Guide for selection of insulators in respect of polluted conditions

6.0. GENERAL REQUIREMENTS

- 6.1. The current transformers shall be single phase, 50Hz, oil immersed and self cooled type, suitable for the services indicated and conforming to the best modern practice of design and manufacture. The design of current transformers shall be such that its accuracy shall not be affected by the presence of pollution on the external surface of its insulators.
- 6.2. The locations for installation of current transformers are situated in seismic zone- V. The design and construction shall be such as to provide necessary protection against the earthquake forces. Dampers and/or additional supporting structures may be provided with the current transformers, if necessary, to cater for their operation in the seismic zone.

6.3 CORES:

The cores for the current transformers shall be of high grade non-ageing electrical silicon laminated steel of low hysteresis loss and high permeability to ensure high accuracy at both normal and over current.

The cores to be used for metering and indicating instruments shall have a saturation factor low enough not to cause any damage to meters and instruments in the event of maximum short circuit currents.

The cores to be used for distance protection and differential protection shall have a high saturation factor. Magnetisation characteristics curves of these cores shall be furnished alongwith the bid.

6.4 WINDINGS:

Primary winding consisting of suitable number and size of conductors shall be insulated with special paper having high mechanical strength, high electrical withstand properties and good ageing qualities. The primary winding shall be of suitably insulated electrolytic copper wire.

The rating of the secondary windings shall be one Ampere. The secondary terminal shall be brought out in a compartment for easy access. The secondary terminals shall be provided with shorting arrangements.

The secondary taps shall be adequately reinforced to withstand the normal handling without damage. Suitably insulated copper wire of electrolytic grade shall be used for secondary windings.

6.5 TANK:

Each current transformer shall be of Live Tank type to be supplied filled with insulating oil and shall be hermetically sealed to prevent atmosphere from coming into contact with oil, avoid filtration and change of oil. In case, the tenderer intends to use nitrogen or any other inert gas above the oil level as to permit expansion and contraction of oil, the same shall be stated in the tender.

Both expansion chamber and tank of the current transformer shall be made of high quality steel and shall be able to withstand full vacuum and pressure occurring during transit, and thermal and mechanical stresses resulting from maximum short circuit current during operation.

All interiors or exteriors of tanks, secondary box and other metal parts shall be thoroughly cleaned to remove all rust, scales, corrosion, grease or other adhering foreign matters. All steel surfaces in contact with insulating oil as far as accessible shall be painted with not less than two coats of heat resistant oil insulating varnish. Steel surface exposed to atmosphere if not hotdip galvanized shall be given a priming coat of zinc chromate and two coats of light grey rust preventing paint. Other ferrous parts shall be hot-dip galvanized as per relevant standard.

The metal tank shall have bare minimum number of welded joints so as to minimize possible locations of oil leakage.

Metal tank of the current transformer shall be provided with two separate earthing terminals for bolted connection to 50x6 mm. flat to be provided by the purchaser for connection to the station earth mat. The earthing terminals shall be provided complete with adequate size washers, nuts and bolts.

The current transformer shall be provided with suitable lifting arrangement for lifting of the entire unit. The lifting arrangement (lifting eye) shall be positioned such that the porcelain bushings and tank shall not be damaged during lifting for transportation/installation.

6.6 TERMINAL CONNECTORS:

Appropriate number of terminal connectors suitable for **ACSR Panther/Dog** conductor shall be supplied. Suitable terminal connectors for earth connections shall also be supplied.

6.7 BUSHINGS:

The bushing and terminal insulator, where provided for the current transformer shall conform to the latest edition of IS: 2099. The bushings shall be made of homogeneous, vitreous porcelain of high mechanical and dielectric strength. Glazing of porcelain shall be of uniform brown or dark brown colour with smooth surface, arranged to shed away rain water or condensed water particles.

The bushings shall have ample insulation, mechanical strength and rigidity for the conditions under which they will be used and shall be designed to prevent accumulation of explosive gases and to provide adequate oil circulation to remove internal heat. There shall be no undue stressing of any part of the bushings due to temperature changes and adequate means shall be provided to accommodate conductor expansion.

The bushings shall be so designed that when operating at the specified highest system voltage there will be no electric discharge between the conductors and bushings. No corrosion or injury would be caused to conductor, insulation or supports by the formation of substances produced by chemical action. The insulation of bushing shall be coordinated with that of the current transformer such that flash-over will occur only externally to the current transformers. The bushing should not cause radio disturbances when operated at rated voltage.

6.8 TERMINAL BOX AND JUNCTION BOX:

All secondary terminals shall be brought out in a weather proof terminal box on one side of each current transformer. The exterior of this terminal box shall be hot dip galvanised. A terminal board for short circuiting of secondary terminals shall be provided.

Cable box along with necessary glands for receiving control cables suitable for mounting on the bottom plate of the terminal box shall be included in the scope of supply.

A door with locking arrangements shall be provided in the front of the terminal box so as to permit easy access to the secondary terminals. The door shall have suitable arrangement to check ingress of moisture into the terminal box.

All terminals shall be clearly marked with identification number to facilitate connection to external wiring.

Polarity shall be indelibly marked on each primary and secondary terminal. In addition to terminal box on each current transformer, tenderer shall also supply a **common junction box for each set of three current transformers of each circuit**. The junction box shall be weather proof type suitable for mounting on the steel structure.

The terminal boxes and junction boxes shall be suitable for outdoor installation and shall conform to IP55 protection class (As per IS 2147).

6.9 OIL LEVEL GAUGE:

An oil level gauge shall be provided to indicate the oil level in the current transformer. The oil gauge shall be mounted in such a way that the oil level can be seen from the ground level.

6.10 PRESSURE RELIEVING DEVICES:

Each current transformer shall be provided with a pressure relieving device so as to prevent bursting of current transformer even under unfavourable conditions.

6.11 OIL DRAIN COCK:

An oil drain cock alongwith a stop cock shall be provided in the bottom flange so as to permit taking of oil samples for testing.

6.12 OIL FILLING COCK:

An oil filling cock alongwith a stop cock shall be provided for filling the oil in the current transformer.

6.13 MOUNTING STRUCTURES:

The current transformers shall be mounted on existing structures. The tenderer shall ensure that the CTs supplied can be mounted on the existing steel (galvanized) structures. Necessary connecting materials such as clamps, bolts, nuts, washers, etc. for the supporting structures shall be supplied by the tenderer.

6.14 RATING PLATE:

Each current transformer shall be provided with a non-corrosive rating plate in accordance with latest edition of IS:2705 Part-I. Following additional particulars shall also be marked on the rating plate of each current transformer.

- a) Purpose (measurement or protection), rated output at 0.9 PF lagging, rated accuracy factor and rated class of accuracy of each secondary winding in terms of IS: 2705.
- b) Terminal numbering of each secondary winding.
- c) Knee point voltage.
- d) Maximum exciting current at knee point voltage.
- e) Secondary winding resistance at 75°C.
- f) Rated instrument security factor in respect of winding meant for measurement and metering.
- g) Rated current, extended current rating (if specified) and rated thermal current.
- h) Year of manufacture.

6.15 INSULATING OIL:

The quantity of oil for first filling of each CT and the completes pecifications of oil proposed to be used shall be stated. It would be desirable to use oil conforming to the provisions of latest IS: 335.

6.16 TESTS:

ROUTINE TESTS:

Each current transformer shall be subjected to routine tests as specified in the latest edition of IS:2705 (Part I to IV). If the purchaser wishes to have a representative, tests shall be performed in his presence so as to be witnessed by him.

The routine tests shall consist of the following:

- (a) Verification of terminal markings and polarity
- (b) Power frequency dry withstand tests on primary winding
- (c) Power frequency dry withstand test on secondary windings
- (d) Overvoltage inter-turn test
- (e) Partial discharge tests
- (f) Determination of errors or other characteristics according to the requirements of the appropriate designation or accuracy class as per individual parts of IS: 2705.
- (g) Knee-point voltage and exciting current for PS Class cores
- (h) Secondary winding resistance for PS Class cores
- (i) Turns ratio for PS Class cores
- (j) Measurement of Capacitance.
- (k) Oil leakage test.

- (l) Measurement of tan delta at 0.3, 0.7, 1.0 Um/ $\sqrt{3}$ and 10kV

At factory/works tests the Tan Delta shall not exceed 0.3% (at Um/ $\sqrt{3}$). The same shall not exceed 0.7% at the end of warranty period (refer SCC clause 5.11.0). If tan delta value of CTs exceed prescribed limit of 0.7% within warranty period, it will be considered as failure within warranty period (Tan delta & capacitance test of CTs shall be measured at 10kV at site). The bidder has to replenish failed CTs within guarantee period without any cost implication to P&EDM.

TYPE TESTS:

The bidder shall furnish four sets of all the type test reports from CPRI or other accredited laboratories alongwith the offer. The type tests must have been conducted less than five years from the date of opening of bid. The Purchaser reserves the right to repeat the type tests in the presence of a representative at the cost of the Supplier.

The type tests shall be in accordance with the latest edition of IS:2705 (Part-I to IV), and shall consist of the following:

- (a) Short-time current test
- (b) High voltage power frequency wet withstand test
- (c) Determination of errors or other characteristics according to the requirements of the appropriate designation or accuracy class as per individual parts of IS: 2705.
- (d) Temperature rise test
- (e) Lightning impulse voltage test
- (f) Degree of protection tests of secondary terminal, junction box

All the test reports shall be submitted and got approved by the purchaser, before dispatch of the equipment.

SPECIAL TESTS/ ADDITIONAL TEST:

The special tests shall consist of the following:

- (a) Chopped lightning impulse test as a type test
- (b) Measurement of dielectric dissipation factor for oil immersed current transformers
- (c) Mechanical test

PRE-COMMISSIONING TESTS:

Contractor shall carry out following tests as pre-commissioning tests. Contractor shall also perform any additional test based on specialities of the items as per the field instructions of the equipment Supplier or Employer without any extra cost to the Employer. The Contractor shall arrange all instruments required for conducting these tests along with calibration and shall furnish the list of instruments to the Employer for approval:

- i. Insulation Resistance Test for primary and secondary.
- ii. Polarity test.
- iii. Ratio identification test – checking of all ratios on all cores by primary injection of current.
- iv. Dielectric test of oil (wherever applicable)
- v. Magnetising characteristics test.
- vi. Secondary winding resistance measurement.
- vii. Contact resistance measurement (wherever possible/accessible)

6.17 DRAWINGS AND INSTRUCTION MANUALS:

The tenderer shall submit, with the tender, all the drawings enumerated in this specification to enable to purchaser to assess the suitability of equipments.

As soon as possible after the award of the contract, the manufacturer shall supply two hard copies & soft copy of the following drawings which shall describe the equipment in full details for approval and shall subsequently provide eight complete sets of final approved drawings, one of which shall be auto positive/softcopy suitable for reproduction.

- i. Outline dimensional drawings.
- ii. Assembly Drawings.
- iii. Cross sectional view of the current transformer.
- iv. Drawings giving details of supporting structures and foundation.
- v. Drawing showing the details of terminal connectors.
- vi. Magnetising curves.
- vii. Wiring diagram with polarity mark.

In addition to the above drawings, the tenderer may supply any other drawing, which in his opinion is required to describe the equipment in full details.

After the completion of the erection work, the contractor shall furnish seven sets (including one reproducible on softcopy) of the completion drawings. Six copies of instruction manuals covering instruction for installation and maintenance check tests shall be supplied by the contractor as a part of this contract.

6.18 COMPLETENESS OF EQUIPMENT:

The tenderer shall be complete in all respect and include all accessories which may not be specifically mentioned in this specification but which are essential for the completeness of equipment ordered.

6.19 GUARANTEED TECHNICAL PARTICULARS:

Guaranteed technical particulars as called for in Schedule-I shall be furnished along with the tender. Any tender lacking the complete information in this respect is likely to be rejected. Particulars which are not subject to guarantee shall be clearly marked.

6.20 SCHEDULE OF INSTALLATION:

Tenderer shall furnish a list of similar equipment supplied by him and presently in service.

6.21 PACKING & FORWARDING:

The equipment shall be packed in suitable crates so as to withstand handling during transport and outdoor storage. The supplier must be responsible for any damage to the equipment during transit due to improper and inadequate packing. Any material found short/damaged shall be replaced by the supplier at no extra cost to the purchaser.

6.22. TECHNICAL DATA SHEET FOR CURRENT TRANSFORMER

APPENDIX-I

TECHNICAL REQUIREMENT FOR 33KV & 132 KV CURRENT TRANSFORMERS

The Current Transformers under this specification shall conform to the parameters given below:-

Sl. No.		Specification	
		33KV	132 KV
1	Type of CT/Installation. Single phase, dead	Single phase, dead tank, oil filled, hermetically sealed, outdoor, self cooled.	
2	Type of mounting.	Pedestal type	
3	Suitable for system frequency.	50Hz \pm 5 %	
4	Rated voltage(KVrms)	33	132
5	Nominal system voltage(KVrms)	33	132
6	Highest system voltage (KVrms)	36	145
7	Current ratio (A/A)	600-300-150/1-1-1A (27 nos) 400-200-100/1-1-1A (3 Nos.) 200-100-50/1-1-1A (24 Nos.)	400-200-100/1-1-1A (24 nos) 300-150-75/1-1-1A (24 nos) 100-50-25/1-1-1A (3 nos)
8	Method of earthing the system where the current transformer will be installed.	Solidly effectively earthed.	
9	Rated continuous thermal current (A)	120 % of rated primary current	
10	Acceptable limit of temperature rise above 50°C ambient temperature for continuous operation at rated continuous thermal current.		
(a)	Winding	45°C	
(b)	Oil	40°C	
(c)	External surface of the core, metallic parts in contact		4
11	Acceptable partial discharge level	Less than 10 picco coulombs	
12	Maximum radio interference voltage at 1.1 times the maximum rated voltage.	Less than 500 micro volts	
13	1.2/50micro second lightning impulse withstand voltage (KVP) (dry)	170	650
14	1 minute dry power frequency withstand voltage Primary (KVrms)	70	275
15	Switching Impulse with stand and voltage(KVP)		
16	1 Minute dry power frequency withstand voltage secondary(KVrms)	3	3
17	Minimum creepage distance of porcelain Housing (mm)	900	3625
18	Rated short time withstand current for 1 second at all ratios(KArms)	25 KA	31.5 KA

19	Instrument security factor at all ratios for metering core.	Not more than 5.0
20	Minimum rated short time thermal current density of the primary winding at all ratios(A/mm ²)	As per clause No9.6.3-Note of IS: 2705 (Part-I)/1992
21	Application, current ratio, output burden, accuracy class, minimum knee point voltage, secondary winding resistance, maximum excitation current at minimum knee point voltage etc.	Enclosed in separate sheets for each rating of the Current Transformers.
22	Type of core	Torroidal type
23	Seismic acceleration	0.15g(Vertical) / 0.3g(Horizontal)
24	Dielectric dissipation factor at 145/.1.732KV(for 132KVC.T.)	0.005 or less
25	Accuracy class of standard C.T. to be used during testing towards determination of ratio errors and phase angle errors for metering cores.	0.05 or better

The current transformers of different ratings shall have the following characteristics.

Voltage Rating	Rated transformation ratio/core	Accuracy class at all ratios	Rated Burden at all ratios	Accuracy limit factor/instrument security factor at all ratios	Knee point voltage at all ratios	Purpose.
132 KV	400-200-100/1/1/1A					
	Core-I	0.2s	30 VA	ISF ≤3.5	-	Metering
	Core-II	5P	30 VA	ALF:10	-	O/C&E/F protection.
	Core-III	PS	-	-	70RCT+ 600	Distance protection
	300-150-75/1-1-1A					
	Core-I	0.2s	30 VA	ISF ≤3.5	-	Metering
	Core-II	5P	30 VA	ALF:10	-	O/C&E/F protection.
	Core-III	PS	-	-	70RCT+ 600	Differential protection
	100-50-25/1-1-1A					
	Core-I	0.2s	30 VA	ISF ≤3.5	-	Metering
	Core-II	5P	30 VA	ALF:10	-	O/C&E/F protection.
	Core-III	PS	-	-	70RCT+ 600	Differential protection

33 KV	600-300-150/1/1/1A					
	Core-I	0.2s	30 VA	ISF ≤ 3.5	-	Metering
	Core-II	5P	30 VA	ALF:10	-	O/C&E/F protection.
	Core-III	PS	-	-	40RCT+ 155	Distance protection
	400-200-100/1/1/1A					
	Core-I	0.2s	30 VA	ISF ≤ 3.5	-	Metering
	Core-II	5P	30 VA	ALF:10	-	O/C&E/F protection.
	Core-III	PS	-	-	40RCT+ 155	Differential protection
	200-100-50/1/1/1A					
	Core-I	0.2s	30 VA	ISF ≤ 3.5	-	Metering
	Core-II	5P	30 VA	ALF:10	-	O/C&E/F protection.
	Core-III	PS	-	-	40RCT+ 155	Differential protection

7.0. ERECTION, TESTING AND COMMISSIONING

7.1 Bidders should note that, most of the equipment covered under this specifications shall be used in replacing old and obsolete equipment in existing substations. The equipment shall be installed on existing mounting structures by retrofitting. Retrofitting also include use of earthing arrangement of existing Current transformers. ***Prices quoted for Erection shall be inclusive of all cost of such retrofitting including supply of any materials to complete the job and cost of dismantling of existing equipment.***

7.2 It is responsibility of Supplier/Contractor to store the dismantled Current transformers in a safe manner at a location inside the substation complex as directed by the site Engineer of P&EDM.

7.3 As most of the equipment shall be used for replacement of existing old equipment, shutdown of the system may require. In view of this, the supplier/manufacture shall give their substation/equipment wise erection, testing and commissioning schedules at least **15 (fifteen)** days ahead.

TECHNICAL SPECIFICATION
OF 132kV & 33kV Voltage Transformer

1.0. SCOPE

1.1. This specification covers :

- a) Design, manufacture, testing at manufacturer's works of 132 kV & 33 kV Voltage Transformer with all fittings and accessories excluding mounting structures.
- b) Loading at manufacturer's works, transportation and delivery at respective substation sites, including unloading at destination sites.
- c) Erection, Testing and Commissioning of Voltage Transformers including dismantling of existing equipments.

2.0. SERVICE CONDITIONS

2.1. The plant and materials supplied shall be suitable for operation under the following climatic and other conditions:

- | | | | |
|----|----------------------------------|---|------------------------------|
| a) | Maximum ambient temperature | : | 50° C |
| b) | Minimum ambient temperature | : | 4° C |
| c) | Relative humidity | : | 35% to 98% |
| d) | Average annual rainfall. | : | 3000 mm |
| e) | No of months of tropical monsoon | : | 6 months (May to Oct) |
| f) | Seismic Zone | : | V |
| g) | Maximum altitude level. | : | Above 2210m above sea level. |

3.0. TYPE TEST REPORTS

- 3.1. Equipment, which have never been tested for critical performance, shall not be accepted. In such cases, a promise or agreement by a bidder to have the equipment tested after award of a contract is not acceptable.
- 3.2. All Bids must be accompanied by the full Type Test Certificates of equipment offered. Such type test certificates shall be acceptable only if:-
 - (a) Tests are conducted in an independent and well known testing laboratory, or
 - (b) Tests are conducted in manufacturer's own laboratory. In this case (i) the laboratory must have ISO 9000 (or its equivalent) series certification; and (ii) tests have been witnessed by technically qualified representatives of earlier clients or purchaser.
- 3.3. Test reports to be acceptable must be related directly to the materials offered. Test reports for higher class of equipment are acceptable with commitment to perform the type tests free of any charge on the particular equipment(s) after the award of contract.
- 3.4. Type Test Reports older than five (5) years on the date of bid opening shall not be accepted.

4.0. GUARANTEED TECHNICAL PARTICULARS

- 4.1. The Guaranteed Technical Particulars of the various items shall be furnished by the Bidders in the prescribed Schedules of this Section with the Bid. The Bidder shall also furnish any other information's as in their opinion is needed to give full description and details to judge the item(s) offered by them.
- 4.2. The data furnished in Guaranteed Technical Particulars should be the minimum or maximum value (as per the requirement of the specification) required. A Bidder may guarantee a value more stringent than the specification requirement. However, for testing purpose or from performance point of view, the material shall be considered

performed successfully if it achieves the minimum/maximum value required as per the technical specification. No preference whatsoever shall be given to the bidder offering better/more stringent values than those required as per specification except where stated otherwise.

5.0. STANDARDS:

The items shall conform in all respects to the following relevant standards/regulations with latest amendments thereof:

Sl. No.	Relevant Standards	Title
1	IS 3156 (Part I to III)	Voltage transformers
2	IS 4146	Application guide for voltage transformers.
3	IS 2099	High voltage porcelain bushings
4	IS 11322	Partial discharge measurement in instrument transformer
5	IS 2071	Methods of high voltage testing
6	IS 335	Insulating oil
7	IS 13947 (Part I), IS 12063	Degree of protection provided by enclosures for low voltage switchgear and control
8	IEC 60044 - 2	Voltage transformers
9	IS 5561	Electric power connections – terminal connectors
10	IS 4759	Hot dip zinc coatings on structural steel and other allied products
11	IS 2633	Methods of testing weight, thickness and uniformity of coating on hot dipped galvanised articles
12	IS 13134	Guide for selection of insulators in respect of polluted conditions

6.0 GENERAL REQUIREMENTS:

- 6.1 The voltage transformers shall be complete in all respects conforming to the modern practice for design and manufacture. The design of voltage transformers shall be such that its accuracy shall not be affected by the presence of pollution on the external surface of its insulators.
- 6.2 The locations for installation of voltage transformers are situated in seismic zone - V. The design and construction shall be such as to provide necessary protection against the earthquake forces. Dampers and/or additional supporting structures may be provided with the voltage transformers, if necessary, to cater for their operation in the seismic zone.
- 6.3. **CORES:**
The core shall be of high grade non-ageing, electrical silicon laminated steel of low hysteresis and eddy current losses and high permeability to ensure high accuracy at both normal and over voltages.
- 6.4. **WINDINGS:**
Primary windings: The primary winding of the voltage transformer shall be connected in phase to neutral with the neutral point solidly earthed. The neutral of the system is also solidly earthed. The primary winding shall be of suitably insulated electrolytic copper wire.
Secondary windings: The voltage transformer shall be provided with two separate secondary windings rated for $110V/\sqrt{3}$ and $110V/\sqrt{3}$. Suitably insulated

copper wire of electrolytic grade shall be used for secondary windings.

6.5 TANK:

Each voltage transformer shall be supplied filled with insulating oil and shall be hermetically sealed to prevent atmosphere from coming into contact with oil, avoid filtration and change of oil.

The tank shall be fitted with oil gauge and provisions for convenient filling and draining of oil. The oil gauge shall be mounted in such a way that the oil level can be seen from the ground level.

Both expansion chamber and tank of the voltage transformer shall be made of high quality steel and shall be able to withstand full vacuum and pressure occurring during transit, and thermal and mechanical stresses resulting from maximum short circuit current during operation.

The tank shall be given three coats of rust preventing paint. Other ferrous parts shall be hot-dip galvanised as per relevant standard.

The metal tank shall have bare minimum number of welded joints so as to minimize possible locations of oil leakage.

Metal tank of the voltage transformer shall be provided with two separate earthing terminals for bolted connection to 50 x 8 mm m.s. flat to be provided by the purchaser for connection to the station earth mat. The earthing terminals shall be provided complete with adequate size washers, nuts and bolts.

The voltage transformer shall be provided with suitable lifting arrangement for lifting of the entire unit. The lifting arrangement (lifting eye) shall be positioned such that the porcelain bushings and tank shall not be damaged during lifting for transportation/installation.

The voltage transformer shall be constructed such that it can be easily transported to site within the allowable transport limitation and in horizontal position, if the transport limitations so demand.

6.6 BUSHING:

a) Oil filled condenser type porcelain bushings shall be used on the voltage transformers. The porcelain shall be homogenous, thoroughly vitrified, tough and impervious to moisture. The glazing of porcelain shall be of uniform brown colour, free from blisters, burns and other similar defects. The bushings shall have ample insulation, mechanical strength and rigidity for the conditions under which they will be used and shall be designed to prevent accumulation of explosive gases and to provide adequate oil circulation to remove internal heat. There shall be no undue stressing of any part of the bushings due to temperature changes and adequate means shall be provided to accommodate conductor expansion.

b) The bushings shall be so designed that when operating at the specified highest system voltage there will be no electric discharge between the conductors and bushings. No corrosion or injury would be cause to conductor, insulation or supports by the formation of substances produced by chemical action. The insulation of bushing shall be coordinated with that of the voltage transformer such that flash-over will occur only externally to the voltage transformers. The bushing should not cause radio disturbances when operated at rated voltage.

c) In general the bushings shall conform to the latest issue of IS: 2099 or equivalent.

d) Each of the bushings shall be complete with the following fittings.

i. Bimetallic expansion type terminal connector complete with washers bolts/nuts.

- ii. Oil level sight gauge and convenient means of filling, sampling and drawing of oil.
- iii. End shield for even distribution of stresses.
- iv. Corona shields for bushing, if required.

6.7 TEMPERATURE RISE:

Voltage transformers shall be capable of carrying their rated burden continuously at rated voltage and frequency without the temperature rise exceeding the limits laid down in the approved standard, to which they are designed and corrected to difference in ambient temperature at site and that given in the standard. The temperature rise at 1.2 times rated primary voltage when applied continuously at rated frequency and at rated burden shall not exceed the limits specified in the standard and the temperature rise at 1.5 times rated primary voltage when applied for 30 seconds starting from previous stable operation condition at rated frequency and rated burden shall not exceed the temperature limits by more than 10°C.

6.8 PRESSURE RELIEVING DEVICE:

Each voltage transformer shall be provided with a pressure relieving device capable of releasing abnormal internal pressure.

6.9 INSULATING OIL:

The quantity of the insulating oil for first filling of each voltage transformer and the complete specifications of oil proposed to be used shall be stated. The oil preferably conforms to the requirement of latest IS: 335 or equivalent IEC standard.

6.10 MOUNTING STRUCTURES:

The voltage transformers shall be mounted on existing structures. The tenderer shall ensure that the VTs supplied can be mounted on the existing steel (galvanized) structures. Necessary connecting materials such as clamps, bolts, nuts, washers, etc. for the supporting structures shall be supplied by the tenderer.

6.11 TERMINAL CONNECTORS:

Terminal connectors suitable for **ACSR Panther/Dog** conductors shall be supplied. Suitable terminal connectors for earthing connections shall also be supplied.

6.12 TERMINAL BOX AND JUNCTION BOX:

Each voltage transformer shall be provided with one or more terminal boxes suitably located to house the terminals of the two secondary windings. The terminal box shall be outdoor type, vermin proof and shall be provided with a door in front so as to have easy access to the secondary terminals. The door shall have a sealing/locking arrangement and shall be suitable to prevent penetration of moisture and rain water.

The terminal box shall be provided with removable gland plate and glands suitable for 1100 volts grade PVC insulated, PVC sheathed multi-core 2.5 sq. mm. to 10 sq. mm. stranded copper conductor cable.

The terminal box, with the cover closed and tightened and the cable/conduit in position when supplied shall have degree of protection not less than IP55 conforming to latest issue of IS:13947 (Part I).

Polarity shall be indelibly marked at the secondary terminals in the terminal box.

In addition to terminal box on each voltage transformer, tenderer shall also supply a common junction box for each set of three voltage transformers of each circuit. The junction box shall be weather proof type suitable for mounting on the steel structure.

Sufficient number of terminals shall be provided in the junction box for

connecting the leads from individual voltage transformer and formation of star or delta as required and to relay metering in the control room.

6.13 MARKING:

i) **RATING PLATE:**

Each voltage transformer shall be provided with a non-corrosive and non-rusting name and rating plate as per latest issue of IS: 3156 (Part-I). The plates shall have information such as rated output, accuracy, terminal numbering of secondary windings, as well, as the following indelibly marked on it.

- a) Manufacturer's name and country of origin.
- b) Manufacturer's serial number.
- c) Rated transformer ratio.
- d) Rated frequency.
- e) Rated output per phase and accuracy class.
- f) Number of phase and method of connection.
- g) Type of transformer
- h) Highest system voltage
- i) Insulation level.

ii) **TERMINAL MARKING:**

The terminal marking shall identify –

- a) The primary & secondary winding.
- b) The winding section if any.
- c) The relative polarities of windings.

iii) **METHOD OF MARKING:**

- a) The terminals shall be marked clearly and indelibly either on the surface or in their immediate vicinity.
- b) The marking shall consist of letter followed by numbers.

6.14 TESTS:

ROUTINE TESTS:

Each voltage transformer shall be subjected to routine tests as specified in the latest edition of IS: 3156 (Part I to III). If the purchaser wishes to have a representative, tests shall be performed in his presence so as to be witnessed by him.

The routine tests shall consist of the following:

- (a) Verification of terminal markings and polarity
- (b) Power frequency tests on primary winding
- (c) Power frequency test on secondary windings
- (d) Determination of errors
- (e) Oil leakage test

TYPE TESTS:

The bidder shall furnish four sets of all the type test reports along with the offer. The type tests must have been conducted less than five years from the date of opening of bid. The Purchaser reserves the right to repeat the type tests in the presence of a representative at the cost of the Supplier.

The type tests shall consist of the following:

- (a) Verification of terminal markings and polarity
- (b) Power frequency tests on primary winding
- (c) Power frequency test on secondary windings
- (d) Determination of errors
- (e) Temperature rise test
- (f) Impulse voltage test

- (g) Degree of protection of secondary terminal box
- (h) Partial discharge measurement

PRE-COMMISSIONING TESTS:

Contractor shall carry out following tests as pre-commissioning tests. Contractor shall also perform any additional test based on specialities of the items as per the field instructions of the equipment Supplier or Employer without any extra cost to the Employer. The Contractor shall arrange all instruments required for conducting these tests along with calibration and shall furnish the list of instruments to the Employer for approval:

- i. Insulation Resistance Test for primary (if applicable) and secondary.
- ii. Polarity test.
- iii. Ratio test.
- iv. Dielectric test of oil (wherever applicable)
- v. Tan delta and capacitance measurement of individual capacitor stacks.
- vi. Secondary winding resistance measurement.

6.15 COMPLETENESS OF THE EQUIPMENT:-

The tenderer shall be complete in all respect and include all accessories which may not be specifically mentioned in this specification but which are essential for the completeness of the equipment ordered.

6.16 GUARANTEED & TECHNICAL PARTICULARS:-

Guaranteed technical particulars as called for shall be furnished along with the tender. Any tender lacking complete information in this respect is likely to be rejected. Particulars which are subject to guarantee shall be clearly marked.

6.17 SCHEDULE OF INSTALLATION:-

Tenderer shall furnish a list of similar equipment supplied by him and presently in service.

6.18 PACKING & FORWARDING:

The equipment shall be packed in suitable crates so as to withstand handling during transport and outdoor storage. The supplier must be responsible for any damage to the equipment during transit due, to improper and inadequate packing. Any material found short/damaged shall be replaced by the supplier at no extra cost to the purchaser.

6.19 DRAWINGS AND INSTRUCTION MANUALS:

The tenderer shall submit, with the tender, all the drawings enumerated in this specification to enable to purchaser to assess the suitability of equipments.

As soon as possible after the award of the contract, the manufacturer shall supply two hard copies and soft copy of the following drawings which shall describe the equipment in full details for approval and shall subsequently provide eight complete sets of final approved drawings, one of which shall be auto positive/soft copy suitable for reproduction.

- i. Outline dimensional drawings.
- ii. Assembly Drawings.
- iii. Cross sectional view of the voltage transformer.
- iv. Drawings giving details of supporting structures and foundation.
- v. Drawing showing the details of terminal connectors.
- vi. Magnetising curves.
- vii. Wiring diagram with polarity mark.

In addition to the above drawings, the tenderer may supply any other drawing, which in his opinion is required to describe the equipment in full details.

After the completion of the erection work, the contractor shall furnish seven sets (including one reproducible on soft copy) of the completion drawings. Six copies of instruction manuals covering instruction for installation and maintenance check tests shall be supplied by the contractor as a part of this contract.

TECHNICAL DATA SHEET FOR VOLTAGE TRANSFORMER

APPENDIX-I

TECHNICAL REQUIREMENT FOR 132kV and 33kV VOLTAGE TRANSFORMERS

- a. The voltage transformer shall be single phase, oil immersed, self-cooled, core type suitable for outdoor operation, effectively earthed under the climatic condition as given in this specification.
- b. The voltage transformers shall have the following ratings:

Sl. No.	Item	Specification	
		132 kV	33 kV
1	Normal system voltage	132 kV	33 kV
2	Highest system voltage	145 kV	36 kV
3	Frequency	50 Hz \pm 5%	
4	System of earthing	Effectively earthed	
5	Ratio	132/ $\sqrt{3}$ KV: 110/ $\sqrt{3}$ V- 110V/ $\sqrt{3}$	33/ $\sqrt{3}$ KV: 110V/ $\sqrt{3}$ V- 110V/ $\sqrt{3}$
6	No. of secondary	Two	
7	Rated burden:		
	(a) Winding I	200 VA	100 VA
	(b) Winding II	100 VA	75 VA
8	Class of accuracy:		
	(a) Winding I	0.2 (Metering)	
	(b) Winding II	3P (Protection)	
9	Power frequency withstand voltage for one minute	275 KV	70 KV
10	Lightning impulse withstand voltage	650 KV	170 KV
11	Fault level	25.0 kA	20.0 kA
12	Rated short circuit withstand capability	31.5kA	25.0 kA
13	Class of insulation	A	
14	Rated voltage factor	1.2 – continuous, 1.5 for 30 seconds	
15	Bushing creepage distance (mm)	3625	

7.0. ERECTION, TESTING AND COMMISSIONING

- 7.1 Bidders should note that, the equipment covered under this specification shall be used in replacing old and obsolete equipment in existing substations. The equipment shall be installed on existing mounting structures by retrofitting. Retrofitting also include use of earthing arrangement of existing Voltage transformers. ***Prices quoted for Erection shall be inclusive of all cost of such retrofitting including supply of any materials to complete the job and cost of dismantling of existing equipment.***
- 7.2 It is responsibility of Supplier/Contractor to store the dismantled Voltage transformers in a safe manner at a location inside the substation complex as directed by the site Engineer of P&EDM.
- 7.3 As the most of the equipment shall be used for replacement of existing old equipment, shutdown of the system may require. In view of this, the supplier/Contractor/manufacture shall give their substation/equipment wise erection, testing and commissioning schedules at least **15 (fifteen)** days ahead.

**TECHNICAL SPECIFICATION
FOR 132kV CAPACITOR VOLTAGE TRANSFORMER**

1.0. SCOPE

1.1 The brief description of scope covered under this Bidding Document is furnished below:

- a) Design, manufacture, testing at manufacturer's works of 132kV Capacitor Voltage Transformers with all fittings and accessories including mounting structures as applicable.
- b) Loading at manufacturer's works, transportation and delivery at respective substation sites, including unloading at destination sites.
- c) Erection, Testing and Commissioning of Capacitor Voltage Transformers including dismantling of existing equipments..

2.0. SERVICE CONDITIONS

2.1. The plant and materials supplied shall be suitable for operation under the following climatic and other conditions:

- | | | |
|----|----------------------------------|--------------------------------|
| a) | Maximum ambient temperature | : 50° C |
| b) | Minimum ambient temperature | : 4° C |
| c) | Relative humidity | : 35% to 98% |
| d) | Average annual rainfall. | : 3000 mm |
| e) | No of months of tropical monsoon | : 6 months (May to Oct) |
| f) | Seismic Zone | : V |
| g) | Maximum altitude | : Above 2210m above sea level. |

3.0. TYPE TEST REPORTS

3.1 Equipment, which has never been tested for critical performance, shall not be accepted. In such cases, a promise or agreement by a bidder to have the equipment tested after award of a contract is not acceptable.

3.2 All Bids must be accompanied by the full Type Test Certificates of equipment offered. Such type test certificates shall be acceptable only if:

- (a) Tests are conducted in an independent and well known testing laboratory, or
- (b) Tests are conducted in manufacturer's own laboratory. In this case (i) the laboratory must have ISO 9000 (or its equivalent) series certification; and (ii) tests have been witnessed by technically qualified representatives of earlier clients or purchaser.

3.3 Test reports to be acceptable must be related directly to the materials offered. Test reports for higher class of equipment are acceptable with commitment to perform the type tests free of any charge on the particular equipment(s) after the award of contract.

3.4 **Type Test Reports older than five (5) years on the date of Technical bid opening shall not be accepted**

4.0. GUARANTEED TECHNICAL PARTICULARS

The Guaranteed Technical Particulars of the various items shall be furnished by the Bidders in the **prescribed Schedules** with the Bid. The Bidder shall also furnish any other information's as in their opinion is needed to give full description and details to judge the item(s) offered by them.

The data furnished in Guaranteed Technical Particulars should be the minimum or maximum value (as per the requirement of the specification) required. A Bidder may guarantee a value more stringent than the specification requirement. However, for testing purpose or from performance point of view, the material shall be considered performed

successfully if it achieves the minimum/maximum value required as per the technical specification. No preference what so ever shall be given to the bidder offering better/more stringent values than those required as per specification except where stated otherwise.

5.0. STANDARD

- 5.1 The equipment covered by this specification shall unless otherwise stated be designed, constructed and tested in accordance with the latest revisions of relevant Indian Standards indicated below or equivalent IEC and shall conform to the regulations of local statutory authorities except to the extent explicitly modified in this specification.
- 5.2 In case of any conflict between the Standards and this specification, this specification shall govern. The Capacitor Voltage Transformer shall comply with the latest issue of the following Indian standard:

Sl. No.	Relevant Standards	Title
1	IS: 3156 (Part-IV)	Voltage transformers : Capacitor Voltage Transformer
2	IS: 9348	Coupling Capacitor and Capacitor Dividers

6.0. GENERAL TECHNICAL REQUIREMENTS

- 6.1 The Instrument Transformers shall be of outdoor, oil impregnated paper, single phase, 50Hz, oil immersed, self-cooled and suitable for use in the geographic and meteorological conditions as given in Clause 3.2.1. The Instrument Transformer shall be complete in all respects and shall conform to the modern practice of design and manufacture. All instrument transformers shall be suitable for upright mouning on latticed steel structures.
- 6.2. The Capacitor Voltage Transformers shall be of Live Tank Design.
- 6.3. The Capacitor Voltage Transformers (CVT) shall also be suitable for carrier coupling (PLCC).
- 6.4. The cores of the instrument transformers shall be of high grade, non-aging CRC steel of low hysteresis loss and high permeability.
- 6.5. The instrument transformers shall be truly hermetically sealed to completely prevent the oil inside the tank coming into contact with the outside atmosphere. To take care of oil volume variation the bidders are required to quote the instrument transformers with stainless steel diaphragm (bellow) only. All parts of bellow shall be stainless steel only. A ground glass window shall be provided to monitor the position of the metal bellow.
- 6.6. The instrument transformers shall be completely filled with oil.
- 6.7. Each Instrument Transformer shall be provided with a completely leak proof secondary Terminal Box. All secondary terminals shall be brought out in to the weather proof compartment of one side of each Instrument Transformer for easy access. A terminal board shall have arrangement for series parallel connections and grounding of VT secondary terminals. A cable box along with necessary glands for receiving control cables suitable for mounting on the bottom plate of the terminal box shall be included in the scope of supply. The size of the cable gland will be intimated to the successful tenderer. A door with locking arrangement shall be provided on the front of the terminal box so as to permit easy access to the secondary terminals. The door shall have suitable arrangement to check ingress of moisture into the terminal box. The secondary terminal box shall comply with degree of protection IP-55. A duplicate set of secondary terminals connected through a suitable link shall be provided in the terminal box. One set shall be connected to the terminal secondary leads while the other one shall be connected to external cable leads.
- 6.8. The instrument transformers shall be so designed to withstand the effects of temperature, wind load, short circuit conditions and other adverse conditions.

- 6.9. The instrument transformers shall be designed to ensure that condensation of moisture is controlled by proper selection of organic insulating materials having low moisture absorbing characteristics.
- 6.10. The outer surface of metal tank shall be Hot Dip Galvanized, whereas, the inner portion shall be painted with oil resistive, insoluble paint or hot dip galvanized. The galvanizing shall be as per applicable standard IS:2629 and minimum thickness of zinc coating shall be 610 gm/sq.mt.
- 6.11 **INSULATING OIL**
- 6.11.1. The quantity of insulating oil for instrument transformers and complete specification of oil shall be stated in the tender. The insulating oil shall conform to the requirement of IS-335/IEC-60269 (required for first filling). Non-PCB based synthetic insulating oil conforming to IEC 60869 shall also be used in the capacitor units.
- 6.12 **COMMON MARSHALLING BOXES**
- 6.12.1. One common marshalling box shall be supplied with each 3 numbers of instrument transformers. The marshalling box shall be made of sheet steel and weather proof. The thickness of sheet steel used shall be not less than 3.0mm. It is intended to bring all the secondary terminals to the common marshalling.
- 6.12.2. The outdoor type common marshalling boxes shall conform to the latest edition of IS 5039 and other general requirements specified hereunder.
- 6.12.3. The common marshalling boxes shall be suitable for mounting on the steel mounting structures of the instrument transformers..
- 6.12.4. The enclosures of the common marshalling boxes shall provide a degree of protection of not less than IP 55 (As per IS 2147).
- 6.12.5. The common marshalling box shall be provided with double hinged front doors with pad locking arrangement. All doors and removable covers and plates shall be sealed all around with neoprene gaskets or similar arrangement.
- 6.12.6. Each marshalling box shall be fitted with terminal blocks made out of moulded non-inflammable plastic materials and having adequate number of terminals with binding screws, washers, etc. Secondary terminals of the instrument transformers shall be connected to the respective common terminal blocks of the common marshalling boxes. The terminal blocks shall be arranged to provide maximum accessibility to all conductor terminals.
- 6.12.7. Each terminal shall be suitably marked with identification numbers. Not more than two wires shall be connected to any one terminal. At least 20% spare terminals shall be provided over and above the required number.
- 6.12.8. All terminal strips shall be of isolating type terminals and they will be of minimum 10A continuous current rating.
- 6.12.9. All cable entries shall be from bottom. Suitable removable gland plate shall be provided on the box for this purpose. Necessary number of cable glands shall be supplied fitted on to this gland plate. Cable glands shall be screw on type and made of brass.
- 6.12.10. Each common marshalling box shall be provided with two numbers of earthing terminals of galvanized bolt and nut type.
- 6.12.11 All steel works of common marshalling boxes shall be hot dipped galvanized.
- 6.13 **BUSHING AND INSULATORS**
- 6.13.1. Bushings and insulators shall be of Porcelain, Solid core type. Porcelain used for the manufacture of bushings and insulators shall be homogeneous, free from defects, cavities and other flaws or imperfections that might affect the mechanical or dielectric quality and shall be thoroughly vitrified, tough and impervious to moisture.

- 6.13.2. Glazing of the porcelain shall be of uniform brown colour, free from blisters, burns and other similar defects. Bushings shall be designed to have sufficient mechanical strength and rigidity for the conditions under which they will be used. All bushings of identical ratings shall be interchangeable.
- 6.13.3. Puncture strength of bushings shall be greater than the dry flashover value. When operating at normal voltage, there shall be no electric discharge between the conductors and bushing which would cause corrosion or injury to conductors, insulators or supports by the formation of substances produced by chemical action. No radio interference shall be caused by the bushings when operating at the normal rated voltage.
- 6.13.4. The design of bushing shall be such that the complete bushing is a self-contained unit and no audible discharge shall be detected at a voltage up to a working voltage (Phase Voltage) plus 10%. The minimum creepage distance for severely polluted atmosphere shall be 25mm/kV.
- 6.13.5. Sharp contours in conducting parts should be avoided for breakdown of insulation. The insulators shall be capable to withstand the seismic acceleration of 0.5g in horizontal direction and 0.6g in vertical direction.
- 6.13.6. Bushings shall satisfactorily withstand the insulation level specified in data sheet.
- 6.14. **TEST AND INSPECTION**
- 6.14.1. In accordance with the requirements Clause 3.3.0, Capacitor Voltage Transformers should have been type tested. The successful bidder shall submit the complete Type Test Reports (valid as per above Clause 3.3.0) of equipment of finally selected Manufacturer for the Purchaser's review and record.
- 6.15. **NAME PLATES**
- 6.15.1. Name plates shall conform to the requirements of IS incorporating the year of manufacture. The rated voltage, voltage factor in case of Capacitor Voltage Transformers shall be clearly indicated on the name plate.
- 6.16. **MOUNTING STRUCTURES**
- 6.16.1. All the equipment covered under this specification shall be suitable for mounting on steel structures. Supply of mounting structures is also in the scope of this tender. The support structure shall be of steel hot dip galvanized type.
- 6.16.2. Each equipment shall be furnished complete with base plates, clamps, and washers etc. and other hardware ready for mounting on steel structures.
- 6.17. **SAFETY EARTHING**
- 6.17.1. The non-current carrying metallic parts and equipment shall be connected to station earthing grid. For this two terminals suitable for 40mm X 10mm GI strip shall be provided on each equipment.
- 6.18. **TERMINAL CONNECTORS**
- 6.18.1. The equipment shall be supplied with required number of terminal connectors of approved type suitable for Panther conductor. The type of terminal connector, size of connector, material, and type of installation shall be approved by the Employer, as per installation requirement while approving the equipment drawings.
- 6.19. **PRE-COMMISSIONING TESTS**
- 6.19.1. Contractor shall carry out following tests as pre-commissioning tests. Contractor shall also perform any additional test based on specialities of the items as per the field instructions of the equipment Supplier or Employer without any extra cost to the Employer. The Contractor shall arrange all instruments required for conducting these tests along with calibration

certificates and shall furnish the list of instruments to the Employer for approval:

- (i) Insulation Resistance Test for primary (if applicable) and secondary winding.
- (ii) Polarity Test.
- (iii) Ratio Test
- (iv) Dielectric test of oil (wherever applicable)
- (v) Tan delta and capacitance measurement of individual capacitor stacks.
- (vi) Secondary winding resistance measurement.

6.20 TYPE AND RATING

All instrument transformers shall be outdoor type, single phase, oil immersed, self-cooled suitable for mounting on steel structure. The instrument transformer shall have the following ratings and particulars:

SI No.	Description	Particulars
1.	General	
	(a) Nominal system voltage, kV	132
	(b) Highest system voltage, kV	145
	(c) Rated frequency, Hz	50
	(d) System earthing	Solidly earthed
	(e) Insulation level	
	i) Impulse withstand voltage, kVp	550
	ii) One minute p.f. Withstand voltage kV (rms)	230
	(f) Short time current for one second, kA	31.5
	(g) Minimum creepage distance mm.	3625

6.21 CONSTRUCTION:

The features and constructional details of the Capacitor Voltage Transformers shall be in accordance with the requirement stipulated hereunder:

- a) Capacitor Voltage Transformers shall be complete in all respects and shall conform to the modern practice of design and manufacture.
- b) Capacitor Voltage Transformers shall be outdoor type, single-phase, 50 Hz, housed in 132KV class, oil filled, self-cooled shaded porcelain bushing suitable for operation under the service conditions as specified in general condition of service without protection from sun, rain and dust.
- c) Capacitor Voltage Transformers shall be suitable for upright mounting on steel structures and shall preferably be suitable for horizontal transportation. The bidder shall also offer suitable steel pedestal/stand for CVTs and other outdoor equipment i.e Coupling devices etc and the stand should have a minimum height of 2500 mm.
- d) The Capacitor Voltage Transformers shall be complete with accessories like terminal connector for primary connection, weather proof terminal box for secondary connection, lifting lugs, grounding terminals, oil sight glass, filling and draining plugs and name plate.
- e) The Capacitor Voltage Transformers shall be filled up with insulating oil having

characteristic as per latest IS:335 as specified. Capacitor Voltage Transformers shall be hermetically sealed to eliminate breathing and to prevent ingress of air and moisture into the capacitor stack and into the tank of Capacitor Voltage Transformer. The tank shall have a built-in-provision to dissipate any excessive internal pressure.

- f) The Capacitor Voltage Transformers shall consist of coupling capacitive dividers and electromagnetic units and shall be suitable for coupling the carrier equipment to the 132KV overhead lines.
- g) The coupling of Capacitor Voltage Transformers shall be suitable for the entire carrier frequency range of 40 KHz to 500 KHz. Necessary arrangement for preventing the HF signal to flow to the other circuits shall be provided.
- h) The capacitor divider may consist of primary and secondary capacitance.
- i) The Capacitor Voltage Transformers shall have two secondary windings, one of which are intended for protection and the other one for metering.
- j) Material for Primary and Secondary winding shall be of Copper.
- k) The Capacitor Voltage Transformer secondary shall be protected by HRC cartridge type fuses for all the windings.
- l) The HF terminal shall be kept earthed when not used for PLCC purpose. Earthing link with fastener to be provided for HF terminal.
- m) Capacitor Voltage Transformers shall be suitable for high frequency (HF) coupling required for power line carrier communication.
- n) Connection between coupling device and CVT shall be done by means of 6sq. mm copper wire taped with 11KV insulation

6.22 BUSHING OF CVT:

- a) The bushing shall have insulation, mechanical strength and rigidity for the condition under which then will be used at site and shall be designed to prevent accumulation of explosive gases and provide adequate oil circulation to remove internal heat.
- b) There shall be no undue stressing of any part of the bushing due to temperature change and adequate means shall be provided to accommodate conductor expansion.
- c) The bushing shall not cause any radio interferences when operated at rated system voltage.
- d) All ferrous parts of the bushing including lifting hooks, cast metal end caps, bolts, nuts etc. used on the bushing shall be of high strength and hot dip galvanized as per IS:2633 as amended up to date.
- e) Porcelain used, shall be homogenous, free from laminations, cavities and other flaws or imperfections that might affect the mechanical or dielectric quality and shall be thoroughly vitrified, tough and impervious to moisture.
- f) The glazing of porcelain shall be of uniform brown or dark brown colour, free from blisters, burns and other similar defects and shall have smooth surface arranged to shed away rain water. The porcelain shall have ample insulation, mechanical strength and rigidity for the conditions under which they will be used.
- g) The insulation of the porcelain shall be coordinated with that of the Capacitive voltage transformers such that the flash over, if any, will occur only external to the voltage transformer.
- h) The porcelain shell of the bushing shall be as per IS:5621 or IEC:815.
- i) The porcelain shed shall be alternate long and short as per IEC:815.
- j) Capacitor Voltage Transformers must withstand mechanical stresses resulting from wind pressure of 150Km per hour.

7. INSULATING OIL :

The quantity of insulating oil for filling complete unit shall be stated and the insulation oil

shall comply in all respects with the provisions of the latest edition of IS:335 or IEC Publication 296 (as amended up-to-date).

8. TERMINAL CONNECTORS :

- a) Capacitor Voltage Transformers shall be supplied with primary terminal connector suitable to connect Panther Conductor.
- b) The terminal connectors should conform to the respective specification for clamps and connectors.

9. GROUNDING TERMINALS :

Two grounding terminals shall be provided on the diagonally opposite sides of the tank of each Capacitor Voltage Transformer. The grounding conductor shall be MS flat of size 75 mm x 6 mm.

10. SECONDARY TERMINAL BOX :

- i) All secondary terminals of the Capacitor Voltage Transformers shall be brought out in a weather proof terminal box provided at one side of each voltage transformer for easy access. CVT sec. terminal box shall be made of sheet steel having minimum thickness of 3 mm. However, 2 mm. thickness having powder coated painting is acceptable.
- ii) The terminal box shall be hot-dip galvanized/painted.
- iii) The terminal box shall be provided with a removable cable gland plate at the bottom for mounting three cable glands suitable for 1100V grade, steel wire armoured, PVC sheathed 4 x 2.5 sq. mm. stranded copper conductor cables. The cable glands shall be included within the scope of supply and shall be screw on type and made of brass.
- iv) The terminal box shall be provided with a door on the front so as to permit easy access to secondary terminals. The door shall be provided with locking arrangement to prevent ingress of moisture and water into the terminal box.
- v) The terminal box shall be provided with a terminal board. The terminals shall be so staggered that connection of external cable to any terminal block should be possible without disturbing the rest of the connections. The terminal block arrangements shall be such as to provide maximum accessibility to all conductor terminations.
- vi) The terminal blocks shall be fully enclosed and made of moulded, non-inflammable plastic material and barriers moulded integrally.
- vii) Terminal block arrangements shall be such that it will be possible to connect or disconnect terminals on live circuits.
- viii) All terminals shall be clearly marked with identification number to facilitate connection to external wiring.
- ix) One secondary terminal other than three winding shall be connected through impedance to avoid ferroresonance.
- x) A protective surge arrester shall be provided to prevent breakdown of insulation by incoming surges and to limit abnormal rise of terminal voltage of shunt capacitor/primary winding, tuning reactor/RF choke etc. due to short circuit in transformer secondaries. In case of an alternate arrangement, bidder shall bring out details in the bid.

11. NAME PLATE :

Capacitor Voltage Transformers shall be provided with name plate. Name plate shall conform to the requirements of the relevant IEC incorporating the year of manufacture.

12. PAINTING :

- i) The tank shall either be hot dip galvanized or painted. All steel surfaces shall be cleaned by sand blasting or chemical process as required to produce a smooth surface, free of scale, grease and dirt. Steel surfaces in contact with insulating oil shall be painted with heat resistant oil insoluble insulating varnish.
- ii) External surfaces shall be given a coat of high quality red or yellow chromate primer and finished with two coats of synthetic enamel paints (Light gray as per shade 631 of IS:5).
- iii) Paints shall be carefully selected to withstand tropical heat, rain etc. The paints shall not scale off a crinkle or be removed by abrasion due to normal handling.

13. CONTRACT DRAWING AND MANUALS :

After placement of Purchase Order or Letter of Award (LOA) the contractor shall submit two (2) hard copies and soft copy of drawing/catalogue to the Engineer-in-Chief, Power & Electricity Department Mizoram, New Capital Complex, Aizawl, Mizoram for approval.

- i) Outline general arrangement dimensional drawing of Capacitor Voltage Transformer furnishing front and side elevations, top and bottom plan views, cross sectional view, all accessories and external feature, mounting arrangement on steel structure, spacing and size of the mounting bolts, total and protective creepage distance of the bushing, internal circuit diagram with polarity marks, terminal arrangement for secondary terminal box, size of primary terminals, grounding terminals and lifting lugs, quantity of insulating oil, net and shipping weights, shipping dimensions etc.
- ii) Name and rating plate diagram of the Capacitor Voltage Transformers.
- iii) Foundation and anchor details including dead load and impact load with direction and point of application and also location of Centre of Gravity of CVT.
- iv) Technical catalogue, operation and maintenance manual.
- v) Any other drawings found necessary in addition to those stated above.
- vi) Ten(10) sets of approved drawings and ten(10) copies of erection, operation and maintenance manual for the Capacitor Voltage Transformers in English language shall be submitted for each substation for our record and distribution to site. The manual shall contain the following :
 - a) A brief description of Capacitor Voltage Transformers furnishing the constructional features.
 - b) Operation and maintenance of Capacitor Voltage Transformers.
 - c) Outline general arrangement drawing of Capacitor Voltage Transformers furnishing all the components and accessories.
 - d) Marked erection prints identifying the component parts of Capacitor Voltage Transformers.
 - e) Detailed dimensions, assembly and description of all the accessories.
 - f) Diagram plate, internal circuit diagram of the component parts of the CVT's and terminal arrangement of the secondary terminal box.
 - g) Any other information found necessary in addition to those stated above. h) In all drawings reference of L.O.A. No. shall be mentioned.

14. TEST AT FACTORY AND TEST CERTIFICATES :

The following acceptance test shall be carried out on every lot of Capacitor Voltage Transformers offered for inspection as per latest edition of IS:3156 (Part I to IV) and IEC:358. The entire cost of acceptance and routine test that are to be carried out as per relevant IS & IEC shall be treated as included in quoted price of CVT. Six copies of test reports shall be submitted to the Engineer-in-Chief, Power & Electricity Department Mizoram, New Capital Complex, Aizawl, Mizoram for approval and adequate extra copies

for distribution at site. The contractor shall give at least 21 (twenty-one) days notice in advance of the date when the test will be carried out. Six(6) copies of routine test results of Capacitor Voltage Transformer shall be submitted to the Engineer-in-Chief for approval.

- i) Verification of terminal markings and polarity as per clause 15 of IEC:186 as amended up to date. ii) Power frequency test on the primary winding as per clause 16 of IEC:186 as amended up to date. iii) Power frequency test on the secondary winding as per relevant clause of IEC:186 as amended up to date.
- ii) Determination of error according to the requirement of the appropriate accuracy class as per clause 26 and 36 of IEC:186 as amended up to date.
- iii) Capacitance and loss angle measurement before and after voltage test as per clause 7 and 8 of IEC:358 as amended up to date.
- iv) Partial discharge test on Capacitive dividers as per clause 13.1 of IEC:358 as amended up to date.
- v) Sealing test as per clause 15 of IEC:358 as amended up to date.

Any other acceptance test not mentioned above but required as per relevant IS & IEC shall also be carried out. Selection of samples for acceptance test as well as rejection and retesting shall be guided by relevant IS & IEC.

15. ERECTION AND MAINTENANCE TOOLS :

Special tools and equipment, if any, required for installation and maintenance of Capacitor Voltage Transformers shall be supplied by the Contractor with the Capacitor Voltage Transformers without any extra cost. Quantity of special tools and tackles to be supplied will be decided by the purchaser from the list given by them with the bid.

16. TEST REPORTS AND TYPE TESTS :

CVT offered should be identical with ones on which type testing has been carried out as per relevant IS & IEC. Three sets of complete type test reports carried out in Govt. recognized Test House or Laboratory/NABL accredited laboratory shall have to be submitted. Successful bidder may require to produce original copies of the type test reports at the time of detail Engineering if asked by P&EDM. Each type test report shall comply the following information with test result.

- i. Complete identification, date and serial no.
- ii. Method of application, where applied, duration and interpretation of each test.
- iii. Relevant drawings as documented with test report.

17. GUARANTEE:

Electrical characteristics shall be guaranteed by the bidder. In case of failure of materials to meet the guarantee, P&EDM shall have right to reject the material. Guaranteed Technical Particulars are to be submitted by successful bidder during detailed engineering along with submitted drawings/documents. However, format for submission of GTP shall be handed over to intending bidders at the time of sale of tender documents.

18. SPECIFIC TECHNICAL PARAMETERS

The Capacitor Voltage Transformers shall be suitable for carrier coupling.

1	Total Capacitance (picofarad)	4400 + 10% - 5%
2	a) High frequency capacitance for the entire carrier frequency range b) Equivalent series resistance over the entire carrier frequency range (Ohms)	Within 80% to 150% of rated capacitance. Less than 40
3	Stray capacitance (Pico farads) & stray conductance (micro Siemens) of the low voltage terminal of a complete CVT including Electro Magnetic Unit over the entire carrier frequency range	520 (max) 50
4	One minute power frequency test: a) Withstand voltage between HF (low voltage) terminal of intermediate transformer & earth terminal, kV(rms). b) Withstand voltage for secondary windings & earth terminal, kV(rms). c) Withstand voltage between HF(LV) carrier coupling terminal & earth terminal, kV(rms)	4 3 10
5	Creepage distance Total (mm)	3625
6	Partial discharge level, Pico Coulombs	10
7	Suitable for carrier coupling	Yes

19. ERECTION, TESTING AND COMMISSIONING

Bidders should note that the equipments covered under this specification shall be used for installation in new locations in existing sub-stations. Erection shall be inclusive of cost of new foundation and installations including laying of cable earthing connection to the existing ground mat etc. to complete the job.

It is the responsibility of the supplier/contractor to store the dismantled instrument a safe manner at a location inside the sub-station complex as directed by the site engineer of P&EDM.

As most of the equipments shall be used for replacement of existing old equipment, shutdown of the system may be required. In view of this, the supplier/manufacture shall give their sub-station/ equipment-wise erection, testing and commissioning schedules at least 15 (fifteen) days ahead.

TECHNICAL SPECIFICATION OF
132 KV and 33 KV Surge Arresters

1.0 SCOPE

1.1 The specification covers :

- a) Design, manufacture, testing at manufacturer's works and of 132kV and 33kV 10 kA Station Class heavy duty gapless metal (Zinc) oxide Surge Arrester complete with all fittings and accessories, such as surge monitor, insulating base, terminal connectors etc. **without mounting structures.**
- b) Loading at manufacturer's works, transportation and delivery at respective substation sites, including unloading at destination sites.
- c) Erection, Testing and Commissioning of Surge Arresters including dismantling of existing equipments.

2.0 SERVICE CONDITIONS

2.1 The plant and materials supplied shall be suitable for operation under the following climatic and other conditions:

- | | | |
|-------------------------------------|---|------------------------------|
| a) Maximum ambient temperature | : | 50° C |
| b) Minimum ambient temperature | : | 4° C |
| c) Relative humidity | : | 35% to 98% |
| d) Average annual rainfall. | : | 3000 mm |
| e) No of months of tropical monsoon | : | 6 months (May to October) |
| f) Seismic Zone | : | V |
| g) Maximum altitude | : | Above 2210m above sea level. |

3.0 TYPE TEST REPORTS

3.1 **Equipment, which have never been tested for critical performance, shall not be accepted.** In such cases, a promise or agreement by a bidder to have the equipment tested after award of a contract is not acceptable.

3.2 All Bids must be accompanied by the full Type Test Certificates of equipment offered. Such type test certificates shall be acceptable only if:-

- (a) Tests are conducted in an independent and well known testing laboratory, *or*
- (b) Tests are conducted in manufacturer's own laboratory. In this case (i) the laboratory must have ISO 9000 (or its equivalent) series certification; and (ii) tests have been witnessed by technically qualified representatives of earlier clients or purchaser.

3.3 Test reports to be acceptable must be related directly to the materials offered. Test reports for higher class of equipment are acceptable with commitment to perform the type tests free of any charge on the particular equipment(s) after the award of contract.

3.4 **Type Test Reports older than five (5) years on the date of bid opening shall not be accepted.**

4.0 GUARANTEED TECHNICAL PARTICULARS

4.1 The Guaranteed Technical Particulars of the various items shall be furnished by the Bidders in the prescribed Schedules of this **Section with the Bid**. The Bidder shall also furnish any other information's as in their opinion is needed to give full description and details to judge the item(s) offered by them.

- 4.2 The data furnished in Guaranteed Technical Particulars should be the minimum or maximum value (as per the requirement of the specification) required. A Bidder may guarantee a value more stringent than the specification requirement. However, for testing purpose or from performance point of view, the material shall be considered performed successfully if it achieves the minimum/maximum value required as per the technical specification. No preference what so ever shall be given to the bidder offering better/more stringent values than those required as per specification except where stated otherwise.

5.1 STANDARDS

- 5.1.1 The design, manufacture and performance of Surge Arresters shall comply with IS: 3070 Part-3, unless otherwise specifically specified in this Specification.

5.2 GENERAL REQUIREMENTS

- 5.2.1 The surge arrester shall draw negligible current at operating voltage and at the same time offer least resistance during the flow of surge current.
- 5.2.2 The surge arrester shall consist of non-linear resistor elements placed in series and housed in electrical grade porcelain housing/silicon polymeric of specified creepage distance.
- 5.2.3 The non-linear blocks shall be of sintered metal oxide material. These shall be provided in such a way as to obtain robust construction, with excellent mechanical and electrical properties even after repeated operations.
- 5.2.4 The assembly shall be hermetically sealed with suitable rubber gaskets with effective sealing system arrangement to prevent ingress of moisture.
- 5.2.5 The surge arrester shall be provided with line and earth terminals of suitable size. The ground side terminal of surge arrester shall be connected with 25x6 mm galvanized strip, one end connected to the surge arrester and second end to a separate ground electrode.
- 5.2.6 The surge arrester shall not operate under power frequency and temporary over voltage conditions but under surge conditions, the surge arrester shall change over to the conducting mode
- 5.2.7 The surge arrester shall be suitable for circuit breaker performing 0-0.3sec.-CO-3min-CO- duty in the system.
- 5.2.8 Surge arresters shall have a suitable pressure relief system to avoid damage to the porcelain/ silicon polymeric housing and providing path for flow of rated fault currents in the event of arrester failure.
- 5.2.9 The reference current of the arrester shall be high enough to eliminate the influence of grading and stray capacitance on the measured reference voltage.
- 5.2.10 The arrester shall be capable of handling terminal energy for high surges, external pollution and transient over voltage and have low losses at operating voltages.
- 5.2.11 The Surge Arrester shall be thermally stable and the bidder shall furnish a copy of thermal stability test with the bid.

5.3 ARRESTER HOUSING

- 5.3.1 The arrester housing shall be made up of **polymer for 132 kV & 33 kV systems** and shall be homogenous, free from laminations, cavities and other flaws of imperfections that might affect the mechanical and dielectric quality. The housing

shall be of uniform brown colour, free from blisters, burrs and other similar defects.

5.3.2 The **housing shall be so coordinated that external flashover shall not occur due to application of** any impulse or switching surge voltage up to the maximum design value for arrester. The arresters shall not fail due to contamination. The arrester housings shall be designed for pressure relief class as given in Technical Parameters of the specification.

5.3.3 Sealed housings shall exhibit no measurable leakage.

5.4 FITTINGS & ACCESSORIES

5.4.1 The surge arrester shall be complete with insulating bases, fasteners for stacking units together, surge counters with leakage current meters and terminal connectors.

5.4.2 The terminals shall be non-magnetic, corrosion proof, robust and of adequate size and shall be so located that incoming and outgoing connections are made with minimum possible bends. The top metal cap and base of surge arrester shall be galvanized. The line terminal shall have a built in clamping device which can be adjusted for both horizontal and vertical takeoff.

5.4.3 Grading corona control rings if necessary shall be provided on each complete arrester pole for proper stress distribution.

5.5 SURGE MONITOR

5.5.1 A self-contained discharge counter suitably enclosed for outdoor use and requiring no auxiliary or battery supply for operation shall be provided for each single pole unit. Leakage current meter with suitable scale range to measure leakage current of surge arrester shall also be supplied within the same enclosure. The number of operations performed by the arrester shall be recorded by a suitable cyclometric counter and surge monitor shall be provided with an inspection window. There shall be a provision for putting ammeter to record the current/alarm contacts in the control room if the leakage current exceeds the permitted value. **Similar provision shall be considered for surge counter also.**

5.5.2 Surge monitor shall be mounted on the support structure at a suitable height so that the reading can be taken from ground level through the inspection window and length of connecting leads up to grounding point and bends are minimum.

5.5.3 The surge counter shall be provided with a potential free contact rated for 110 Volt (DC) which shall close whenever a surge is recorded by the surge monitor. **Necessary arrangement shall be provided for extending the contact information to Substation Automation System/RTU.**

5.6 TESTS

5.6.1 Test on Surge Arresters

The Surge Arresters **offered shall be type tested and shall be subjected to routine and acceptance tests in accordance with IS: 3070 (Part-3).** In addition, the suitability of the Surge Arresters shall also be established for the following:

- Residual voltage test
- Reference voltage test
- Leakage current at M.C.O.V

- P.D. test
- Sealing test
- Thermal stability test
- Aging and Energy capability test
- Watt loss test

Each metal oxide block shall be tested for guaranteed specific energy capability in addition to routine/acceptance test as per IEC/IS.

5.6.2 The surge arrester housing shall also be type tested and shall be subjected to routine and acceptance tests in accordance with IS: 2071.

5.6.3 Galvanization Test

All Ferrous parts exposed to atmospheric condition shall have passed the type tests and be subjected to routine and acceptance tests in accordance with IS: 2633 & IS 6745.

5.7 NAME PLATES

5.7.1 The name plate attached to the arrester shall carry the following information:

Rated Voltage
Continuous Operation Voltage
Normal discharge current
Pressure relief rated current
Manufacturers Trade Mark
Name of Sub-station
Year of Manufacturer
Name of the manufacture
Purchase Order Number along with date

5.8 PRE-COMMISSIONING TESTS

5.8.1 Contractor shall carry out following tests as pre-commissioning tests. Contractor shall also perform any additional test based on specialties of the items as per the field instructions of the equipment Supplier or Employer without any extra cost to the Employer. The Contractor shall arrange all instruments required for conducting these tests along with calibration certificates and shall furnish the list of instruments to the Employer for approval.

- (a) Operation check of LA counters.
- (b) Insulation resistance measurement.
- (c) Capacitance and Tan delta measurement of individual stacks.
- (d) Third harmonic resistive current measurement (to be conducted after energisation.)

5.9 TYPE AND RATING:

Sl. No.	Particulars	Voltage class	
		132 kV	33 kV
1	Rated voltage of arrester, kV	120	30
2	Rated frequency, Hz	50	
3	Nominal discharge current of arrester, kA	10	10
4	Maximum residual voltage at nominal discharge current, kV (peak)	395	108
5	Maximum steep current impulse residual voltage at kV (kVP)	440	120
6	One minute power frequency withstand voltage of arrester insulation, kV (rms)	275	70
7	1.2 / 50 \square second impulse withstand voltage of arrester insulation, kV (peak)	650	170
8	Line discharge class	3	2
9	Insulator Housing		
	a) Power frequency withstand test voltage (wet) (kV rms)	275	70
	b) Lightning impulse withstand tests voltage (KVp)	650	170
	c) Pressure Relief Class	40	40
	d) Creepage distance not less than (mm)	3625	900

6.0 ERECTION, TESTING AND COMMISSIONING

- 6.1 Bidders should note that, most of the equipment covered under this specification shall be used in replacing old and obsolete equipment in existing substations. The equipment shall be installed on existing mounting structures by retrofitting. Retrofitting also include use of earthing arrangement of existing Surge Arresters. *Prices quoted for Erection shall be inclusive of all cost of such retrofitting including supply of any materials to complete the job and cost of dismantling of existing equipment.*
- 6.2 It is responsibility of Supplier/Contractor to store the dismantled Surge Arresters in a safe manner at a location inside the substation complex as directed by the site Engineer of P&EDM.
- 6.3 As the most of the equipment shall be used for replacement of existing old equipment, shutdown of the system may require. In view of this, the supplier/manufacturer shall give their substation/equipment wise erection, testing and commissioning schedules at least **15 (fifteen)** days ahead.

TECHNICAL SPECIFICATION OF

132 KV and 33 KV Isolators

1.0 SCOPE

1.1 The brief description of scope covered is furnished below:

- a) Design, manufacture, testing at manufacturer's works and of 132kV and 33kV gang operated switch (Isolators) with all fittings and accessories including mounting structures as applicable. The Isolators are for outdoor installation suitable for horizontally mounting on mounting structures and for use at sub-stations. Isolators shall be supplied with Earth Switch as and where specified.
- b) Loading at manufacturer's works, transportation and delivery at respective substation sites, including unloading at destination sites.
- c) Erection, Testing and Commissioning of Isolators including dismantling of existing equipments.

2.0. SERVICECONDITIONS

2.1. The plant and materials supplied shall be suitable for operation under the following climatic and other conditions:

- | | | | |
|------|----------------------------------|---|------------------------------|
| i. | Maximum ambient temperature | : | 50° C |
| ii. | Minimum ambient temperature | : | 4° C |
| iii. | Relative humidity | : | 35% to 98% |
| iv. | Average annual rainfall. | : | 3000 mm |
| v. | No of months of tropical monsoon | : | 6 months (May to October) |
| vi. | Seismic Zone | : | V |
| vii. | Maximum altitude | : | Above 2210m above sea level. |

3.0 TYPE TEST REPORTS

- 3.1 **Equipment, which have never been tested for critical performance, shall not be accepted.** In such cases, a promise or agreement by a bidder to have the equipment tested after award of a contract is not acceptable.
- 3.2 All Bids must be accompanied by the full Type Test Certificates of equipment offered. Such type test certificates shall be acceptable only if:-
- (a) Tests are conducted in an independent and well known testing laboratory, or
 - (b) Tests are conducted in manufacturer's own laboratory. In this case (i) the laboratory must have ISO 9000 (or its equivalent) series certification; and (ii) tests have been witnessed by technically qualified representatives of earlier clients or purchaser.
- 3.3 Test reports to be acceptable must be related directly to the materials offered. Test reports for higher class of equipment are acceptable with commitment to perform the type tests free of any charge on the particular equipment(s) after the award of contract.
- 3.4 **Type Test Reports older than five (5) years on the date of bid opening shall not be accepted.**

4.0 GUARANTEED TECHNICAL PARTICULARS

- 4.1 The Guaranteed Technical Particulars of the various items shall be furnished by the Bidders in the prescribed Schedules of this Section with the Technical Bid. The Bidder shall also furnish any other information's as in their opinion is needed to give full description and details to judge the item(s) offered by them.
- 4.2 The data furnished in Guaranteed Technical Particulars should be the minimum or maximum value (as per the requirement of the specification) required. A Bidder may

guarantee a value more stringent than the specification requirement. However, for testing purpose or from performance point of view, the material shall be considered performed successfully if it achieves the minimum/maximum value required as per the technical specification. No preference what so ever shall be given to the bidder offering better/more stringent values than those required as per specification except where stated otherwise.

5.0 TECHNICAL SPECIFICATION OF ISOLATORS

5.1 STANDARD

5.1.1 The Isolators and accessories shall conform in general to IEC 9921 or IS: 9921 except to the extent explicitly modified in this Specification.

5.2 GENERAL REQUIREMENTS

5.2.1 Isolators shall be outdoor, off-load type. Earth switches shall be provided on isolators wherever called for, with possibility of being mounted on any side of the isolator.

5.2.2 All isolators shall be double break centre pole type.

5.2.3 All isolating switches and earthing switches shall have rotating blades and pressure releasing contacts. All isolating and earth switches shall operate through 90° angle from closed position to fully open position.

5.2.4 Complete isolator with all the necessary items for successful operation shall be supplied including but not limited to the following:

(i) Isolator assembled with complete base frame, linkages, operating mechanism, control cabinet, interlocks etc.

(ii) All necessary parts to provide a complete and operable isolator installation, control parts and other devices whether specifically called for herein or not.

5.2.5 The isolator shall be designed for use in the geographic and meteorological conditions as given in Clause 2.1.

5.3 DUTY REQUIREMENT

5.3.1 Isolators and earth switches shall be capable of withstanding the dynamic and thermal effects of the maximum possible short circuit current of the systems in their closed position. They shall be constructed such that they do not open under influence of short circuit current.

5.3.2 The earth switches, wherever provided, shall be constructionally interlocked so that the earth switches can be operated only when the isolator is open and vice versa. The constructional interlocks shall be built in construction of isolator and shall be in addition to the electrical and mechanical interlocks provided in the operating mechanism.

5.3.3 In addition to the constructional interlock, isolator and earth switches shall have provision to prevent their electrical and manual operation unless the associated and other interlocking conditions are met. All these interlocks shall be of failsafe type. Suitable individual interlocking coil arrangements shall be provided. The interlocking coil shall be suitable for continuous operation from DC supply and within a variation range as stipulated elsewhere in this specification.

5.3.4 The earthing switches shall be capable of discharging trapped charges of the associated lines.

5.3.5 The isolator shall be capable of making/breaking normal currents when no significant change in voltage occurs across the terminals of each pole of isolator on account of make/break operation.

5.4 CONSTRUCTIONAL DETAILS

5.4.1 All isolating switches and earthing switches shall have rotating blades and pressure releasing contacts. All isolating and earth switches shall operate through 90⁰ angle from closed position to fully open position.

5.4.2 Contacts:

- a) The contacts shall be self-aligning and self-cleaning and so designed that binding cannot occur after remaining closed for prolonged periods of time in a heavily polluted atmosphere.
- b) No undue wear or scuffing shall be evident during the mechanical endurance tests. Contacts and spring shall be designed so that readjustments in contact pressure shall not be necessary throughout the life of the isolator or earthing switch. Each contact or pair of contacts shall be independently sprung so that full pressure is maintained on all contacts at all time.
- c) Contact springs shall not carry any current and shall not lose their characteristics due to heating effects.
- d) The moving contact of double break isolator shall have turn-and -twist type or other suitable type of locking arrangement to ensure adequate contact pressure.

5.4.3 Blades:

- a) All metal parts shall be of non-rusting and non-corroding material. All current carrying parts shall be made from high conductivity electrolytic copper/aluminium. Bolts, screws and pins shall be provided with lock washers. Keys or equivalent locking facilities if provided on current carrying parts, shall be made of copper silicon alloy or stainless steel or equivalent. The bolts or pins used in current carrying parts shall be made of non-corroding material. All ferrous castings except current carrying parts shall be made of malleable cast iron or cast-steel. No grey iron shall be used in the manufacture of any part of the isolator.
- b) The live parts shall be designed to eliminate sharp joints, edges and other corona producing surfaces, where this is impracticable adequate corona shield shall be provided. Corona shields/rings etc., shall be made up of aluminium/aluminium alloy.
- c) Isolators and earthing switches including their operating parts shall be such that they cannot be dislodged from their open or closed positions by short circuit forces, gravity, wind pressure, vibrations, shocks, or accidental touching of the connecting rods of the operating mechanism.
- d) The switch shall be designed such that no lubrication of any part is required except at very infrequent intervals i.e. after every 1000 operations or after 5 years whichever is earlier.

5.4.4 Insulators:

- a) The insulator shall conform to IS: 2544 and/or IEC-60168. The insulators shall have a minimum cantilever strength of **600/400 Kgs. for 132/33 kV** isolators respectively.
- b) Pressure due to the contact shall not be transferred to the insulators after the main blades are fully closed.

5.4.5 Base:

Each isolator shall be provided with a complete galvanised steel base provided with holes and designed for mounting on a supporting structure.

5.5 EARTHING SWITCHES

- 5.5.1 Where earthing switches are specified these shall include the complete operating mechanism and auxiliary contacts.
- 5.5.2 The earthing switches shall form an integral part of the isolator and shall be mounted on the base frame of the isolator.
- 5.5.3 The earthing switches shall be constructionally interlocked with the isolator so that the earthing switches can be operated only when the isolator is open and vice versa. The constructional interlocks shall be built in construction of isolator and shall be in addition to the electrical interlocks.
- 5.5.4 Each earth switch shall be provided with flexible copper/aluminum braids for connection to earth terminal.
These braids shall have the same short time current carrying capacity as the earth blade. The transfer of fault current through swivel connection will not be accepted.
- 5.5.5 The frame of each isolator and earthing switches shall be provided with two reliable earth terminals for connection to the earth mat.
- 5.5.6 Isolator design shall be such as to permit addition of earth switches at a future date. It should be possible to interchange position of earth switch to either side.
- 5.5.7 The earth switch should be able to carry the same fault current as the main blades of the Isolators and shall withstand dynamic stresses.

5.6 OPERATING MECHANISM

- 5.6.1 The bidder shall offer manual operated Isolators and earth switches.
- 5.6.2 Control cabinet/operating mechanism box shall be made of aluminum sheet of adequate thickness (minimum 3 mm).
- 5.6.3 Suitable reduction gearing shall be provided.
- 5.6.4 Manual operation facility (with handle) should be provided with necessary interlock.
- 5.6.5 Gear should be of forged material suitably chosen to avoid bending/jamming on operation after a prolonged period of non operation. Also all gear and connected material should be so chosen/surface treated to avoid rusting.

5.7 OPERATION

- 5.7.1 All the main Isolator and earth switches shall be mechanically gang operated.
- 5.7.2 The design shall be such as to provide maximum reliability under all service conditions. All operating linkages carrying mechanical loads shall be designed for negligible deflection. The length of inter insulator and interpole operating rods shall be capable of adjustments, by means of screw thread which can be locked with a lock nut after an adjustment has been made. The isolator and earth switches shall be provided with “over center” device in the operating mechanism to prevent accidental opening by wind, vibration, short circuit forces or movement of the support structures.
- 5.7.3 Each isolator and earthswitch shall be provided with a manual operating handle enabling one man to open or close the isolator with ease in one movement while standing at ground level. Detachable type manual operating handle shall be provided. Suitable provision shall be made inside the operating mechanism box for parking the detached handles. The provision of manual operation shall be located at a height of 1000 mm from the base of isolator support structure.
- 5.7.4 The isolator shall be provided with positive continuous control throughout the entire cycle of operation. The operating pipes and rods shall be sufficiently

rigid to maintain positive control under the most adverse conditions and when operated in tension or compression for isolator closing. They shall also be capable of withstanding all torsional and bending stresses due to operation of the isolator. Wherever supported the operating rods shall be provided with bearings on either ends. The operating rods/ pipes shall be provided with suitable universal couplings to account for any angular misalignment.

- 5.7.5 All rotating parts shall be provided with grease packed roller or ball bearings in sealed housings designed to prevent the ingress of moisture, dirt or other foreign matter. Bearings pressure shall be kept low to ensure long life and ease of operation. Locking pins wherever used shall be rustproof.
- 5.7.6 Signaling of closed position shall not take place unless it is certain that the movable contacts, have reached a position in which rated normal current, peak withstand current and short time withstand current can be carried safely. Signaling of open position shall not take place unless movable contacts have reached a position such that clearance between contacts is at least 80% of the isolating distance.
- 5.7.7 The position of movable contact system (main blades) of each of the Isolators and earthing switches shall be indicated by a mechanical indicator at the lower end of the vertical rod of shaft for the Isolators and earthing switch. The indicator shall be of metal and shall be visible from operating level.
- 5.7.8 The contractor shall furnish the following details along with quality norms, during detailed engineering stage.
- (i) Current transfer arrangement from main blades of isolator along with millivolt drop immediately across transfer point.
 - (ii) Details to demonstrate smooth transfer of rotary motion from motor shaft to the insulator along with stoppers to prevent over travel.

5.8 TEST AND INSPECTION

- 5.8.1 The following test reports of the type tests shall also be submitted by the successful bidder for the Purchaser's review:
- I) Dielectric tests as per IEC 62271-102 /IS 9921.
 - II) Temperature rise test as per IEC 62271-102 /IS 9921.
 - III) Short time withstand current peak withstand current tests as per IEC 62271-102 /IS 9921.
 - IV) Tests to Prove the Short-Circuit-Making Performance of Earthing Switches as per IEC 62271-102 /IS 9921.
 - V) Operating and Mechanical Endurance Tests as per IEC 62271-102
- 5.8.2 The equipment shall be subjected to the following routine test.
- I) Power frequency voltage dry withstand test on the Main Circuit
 - II) Voltage Tests on control and auxiliary circuits
 - III) Measurement of resistance of the main circuit
 - IV) Mechanical Operating test.
- 5.8.3 The porcelain will have pull out test for embedded component and beam strength of porcelain base.

5.9 AUXILIARY SWITCHES

- 5.9.1 All isolators and earth switches shall be provided with 110 volts, 6 Ampere auxiliary switches for their remote position indication on the control board and for electrical interlocking with other equipment. In addition to the auxiliary

switches required for remote position indications and for their operation. There shall be six pairs of NO and six pairs of NC contacts for each isolating switch and three pairs of NO and three pairs of NC contacts for each earthing switch. All contacts shall be brought out to terminal blocks

5.10 CONNECTORS

5.10.1 Each isolator shall be provided with appropriate number of bimetallic clamping type connectors as detailed in the schedule of requirement. The maximum length of jumper that may be safely connected or any special instruction considered necessary to avoid under loads on the post isolators should be stated by the tenderer.

5.11 SUPPORTING STRUCTURES

5.11.1 All isolators and earthing switches shall be rigidly mounted in an upright position on their own supporting structures. Details of the supporting structures shall be furnished by the successful tenderer. The isolators should have requisite fixing details ready for mounting them on switch structures.

5.12 PRE-COMMISSIONING TESTS

5.12.1 Contractor shall carry out following tests as pre-commissioning tests. Contractor shall also perform any additional test based on specialties of the items as per the field instructions of the equipment Supplier or Employer without any extra cost to the Employer. The Contractor shall arrange all instruments required for conducting these tests along with calibration certificates and shall furnish the list of instruments to the Employer for approval.

- (a) Insulation resistance of each pole.
- (b) Manual and electrical operation and interlocks.
- (c) Insulation resistance of control circuits and motors.
- (d) Ground connections.
- (e) Contact resistance.
- (f) Proper alignment so as to minimise to the extreme possible the vibration during operation.
- (g) Measurement of operating Torque for isolator and Earth switch.
- (h) Resistance of operating and interlocks coils.
- (i) Functional check of the control schematic and electrical & mechanical interlocks.
- (j) 50 operations test on isolator and earth switch.

5.13 TECHNICAL DATA SHEET FOR ISOLATORS

SL	Technical Particulars	Isolators class	
		132 kV	33 kV
1	Nominal system voltage, kV	132	33
2	Highest system voltage, kV	145	36
3	Rated frequency, Hz.	50	50
4	Type of Isolator	Double Break, center pole rotating	Double Break, center pole rotating
5	Rated continuous current, A	1250	1250
6	Rated short time current, kA	31.5	25
7	Rated duration of short time current, Second	1	1
8	Rated lightning impulse withstand voltage, kV (peak) i) To earth & between poles ii) Across isolating distance	650 750	170 195
9	Rated 1 minute power frequency withstand voltage, kV (rms) i) To earth & between poles ii) Across isolating distance	275 460	70 80
10	Minimum creepage distance of insulators, mm		
11	Temperature rise	As per relevant IEC 62271-102/ IS	

6.0 ERECTION, TESTING AND COMMISSIONING

- 6.1 Bidders should note that, the equipment covered in this specification under this bidding document shall be used in replacing old and obsolete equipment in existing substations. Price quoted for erection shall be inclusive of construction of new foundation/existing foundation, erection of mounting structure, connection to riser etc. including dismantling of existing equipments to complete the job.
- 6.2 It is responsibility of Supplier/ Contractor to store the dismantled Isolators in a safe manner at a location inside the substation complex as directed by the site Engineer of P&EDM.
- 6.3 As the most of the equipment shall be used for replacement of existing old equipment, shutdown of the system may require. In view of this, the supplier/manufacturer shall give their substation/equipment wise erection, testing and commissioning schedules at least **15 (fifteen)** days ahead.

TECHNICAL SPECIFICATIONS OF 132kV & 33kV CONTROL & RELAY PANEL

1.0	SCOPE					
1.1	The specification covers design, engineering, manufacture, testing & supply delivery at site, erection, testing and commissioning of Control & relay and protection panels for replacement of existing old panels. The panels should be inclusive of internal wiring and with arrangement for external connection to various Switchyard equipments and Control room building equipments as necessary. The Contractor has to design the Schematics for protection and Control of all equipments including monitoring indications, visual and audible alarm, interlocking schemes between different equipment. Any other requirement which are not specifically covered here but which are necessary for successful commissioning of the Sub-station equipments as a whole are also within the scope of the Contract.					
1.2	It is not the intent to specify here in complete details of design and construction. The equipment manufactured should conform to the relevant standards and of highest quality of engineering design and workmanship. The equipment manufactured shall ensure satisfactory and reliable performance throughout the service life. The Schedule of requirement of the Panel is furnished separately in details.					
2.0	STANDARDS :					
2.1	Unless otherwise specified all equipment and material shall conform to the latest IS applicable standards. Equipment complying with other internationally recognized standards will also be considered if it ensures performance equivalent or superior to Indian standards. In the event of supply of equipment conforming to any international / internationally recognized standards other than the standard listed below, the salient features of comparison shall be brought out and furnished along with the bid. One copy of such standard specification in English language shall be enclosed with the tender.					
2.2	The equipment provided shall also comply with the latest revisions of the Electricity act and Indian Electricity rules and any other applicable Statutory provisions, rules and regulations					
2.3	All equipment provided under the specification shall generally conform to the latest issue of the following:					
	IS 3231 & IEC-255	Electrical relays for power system protection				
	IS 1248 & IS 2419	Indicating Instrument				
	IEC 337 & 337-1, 156875	Control Switches (LV Switching devices for control and auxiliary circuit)				
	IS 2705	Current Transformers				
	IS 3156	Voltage Transformer				
	IS 375, IS 5578	Marking and arrangement for Switchgear Bus bars, main connection and auxiliary wiring.				
	IS 8686	Specification for static protective relays				
3.0	SYSTEM DETAILS :					
		Control and Relay Panels for				
	Sl.No.	Name of Sub-Station	132kV feeders	132kV Transformers	33kV feeders	33kV Transformers
	1.	132kV Luangmual S/S	2	3	6	2
	2.	132kV Zuangtui S/S	3	2		2
	3.	132kV Bukpui S/S			2	2
	4.	132kV Saitual S/S	1	1	1	1
	5.	132KV Bawktlang S/S	4	2		
		Total :	10	8	9	7

4.0 CT & PT RATIO AND TRANSFORMER DETAILS

1. 132kV Luangmual Sub-Station :

Sl.No.	Name of feeders	Existing C.T.Ratios
1.	132kV feeder, Incoming I & II	400-200-100/1-1-1A.
2.	12.5MVA, 132/33kV Transformers 132kV side, Transformer I, II & III	300-150-75/1-1-1A.
	33kV side, Transformer I, II & III	600-300-150/1-1-1A.
3.	33kV feeders, West I, West II, PHE Old, PHE New, IGC, Sairang	200-100-50/1-1-1A.
4.	2.5 & 6.3MVA, 33/11kV Transformers 33kV side	200-100-50/1-1-1A.

2. 132kV Zuangtui Sub-Station :

Sl.No.	Name of feeder	C.T.Ratio
1.	132kV feeder, Incoming, Bukpui, Saitual	400-200-100/1-1-1A.
2.	12.5MVA, 132/33kV Transformers 132kV side, Transformer I, II. ((Tr III, IV)	300-150-75/1-1-1A.
	33kV side	600-300-150/1-1-1A.
3.	33kV Transformer 6.3 MVA Tr I & II	200-100-50/1-1-1A.

3. 132kV Bukpui Sub-Station :

Sl.No.	Name of feeder	C.T.Ratio
1.	33kV feeder	100-50/1-1A.
2.	2.5MVA, 33/11kV Transformers 33kV side	100-50/1-1A.
	11kV side	150-75/5-5A.

4. 132kV Saitual Sub-Station :

Sl.No.	Name of feeder	C.T.Ratio
1.	132kV feeder, Incoming	400-200-100/1-1-1A.
2.	6.3MVA, 132/33kV Transformer 132kV side	300-150-75/1-1-1A.
	33kV side	600-300-150/1-1-1A.
3.	33kV feeder, Darlawn	200-100-50/1-1-1A.
4.	6.3MVA, 33/11kV Transformers 33kV side	600-300-150/1-1-1A.

5. 132kV Bawktlang Sub-Station :

Sl.No.	Name of feeder	C.T.Ratio
1.	132kV feeders, Aizawl I, Bairabi, Tuirial	400-200-100/1-1-1A.
2.	12.5MVA, 132/33kV Transformers 132kV side, Transformer II	300-150-75/1-1-1A.
	33kV side, Transformer II	600-300-150/1-1-1A.
3.	12.5MVA, 132/66kV Transformer 132kV side, Transformer I	300-150-75/1-1-1A.
	66kV side	300-150-75/1-1-1A.
4.	12.5MVA, 66/33kV Transformer 66kV side	300-150-75/1-1-1A.
	33kV Side	600-300-150/1-1-1A.

$$\text{PT RATIO : } \frac{132\text{KV}/\sqrt{3}}{110\text{V}/\sqrt{3}}$$

$$\frac{33\text{kV}/\sqrt{3}}{110\text{V}/\sqrt{3}}$$

GENERAL REQUIREMENTS																			
5.0	<p>AUXILIARY SUPPLY :</p> <p>D.C. Supply voltage shall be normally fed from Battery charger and battery connected in parallel which is 110V +/- 10%. In case of failure of the AC supply to battery charger, DC Supply voltage will be available automatically from lead acid Battery. The D.C Supply voltage may vary from -10% to + 10%. The D.C. system shall be 2 wire with necessary earth fault annunciation scheme. AC Auxiliary supply voltage for the C&R panel shall be 230V, 1-phase, 50Hz grounded with +/- 10% voltage variation.</p>																		
	<p>DRAWINGS : detailed drawings shall be submitted while designing the control and Relay Panels by the contractor for approval of the purchaser.</p>																		
6.0	<p>CONTROL AND RELAY BOARD :</p> <p>The control and relay panel shall be comprising of a section of duplex board consisting of vertical, front and rear steel panel joined together by a steel topped enclosures with an access passage in between and necessary reinforcing steel members, complete with foundation stilts and mounting bolts. The section shall be placed together to form a continuous Board. Each end of the structure shall be fabricated of steel with flush mounted steel in detachable hinged doors and locks. The doors shall be preferably two leaved in order to minimize space required for operating them. The duplex board shall be readily extensible to either direction. On the front panel, shall be mounted the mimic diagram, annunciation, meters, indication, control switches etc. All the protective and auxiliary relays shall be mounted on the rear panel of the duplex Board. The dimension of the duplex board shall be as indicated below:-</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Sl.</th> <th>Description</th> <th>Front width (metres)</th> <th>Depth (metres)</th> <th>Height (metres)</th> <th>Corridor width (metres)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>132/66/33kV Feeder Panel</td> <td>0.8</td> <td>2.0</td> <td>2.3</td> <td>0.76</td> </tr> <tr> <td>2</td> <td>132/66/33kV Transformer Panel</td> <td>1.0</td> <td>2.0</td> <td>2.3</td> <td>0.76</td> </tr> </tbody> </table> <p style="text-align: center;">Layout diagram showing the dimensions are shown in separate sheet enclosed.</p> <p>The Control and Relay Panels for 132/33kV, 132/66kV & 66/33kV transformer shall be for the control and protection of both the HV and LV side of the transformer in one panel. The panels for 33/11kV transformer shall be for the control and protection of the 33kV side of the transformer.</p> <p>The complete panel shall incorporate all necessary instruments, meters, relays, auxiliary relays, control switches, indicating lamps, mimic, annunciators, audible alarms, horizontal and vertical wiring supports, interior lighting system, terminal blocks, fuses and links etc.</p>	Sl.	Description	Front width (metres)	Depth (metres)	Height (metres)	Corridor width (metres)	1	132/66/33kV Feeder Panel	0.8	2.0	2.3	0.76	2	132/66/33kV Transformer Panel	1.0	2.0	2.3	0.76
Sl.	Description	Front width (metres)	Depth (metres)	Height (metres)	Corridor width (metres)														
1	132/66/33kV Feeder Panel	0.8	2.0	2.3	0.76														
2	132/66/33kV Transformer Panel	1.0	2.0	2.3	0.76														
7.0	<p>PAINTING :</p> <p>Panel painting shall be done by the modern process of painting. All unfurnished surface of the steel panel and frame work shall be sand blasted or suitable cured to remove rust, scale, foreign adhering matter or grease. A suitable rust resisting primer shall be applied on the interior and exterior surface of steel, which shall be followed by application of an undercoat suitable to serve as base and binder forth finishing coat. The panel shall be finished to enamel deep Grey for exterior and enamel light Grey for the interior. The Panel shall be given a plastic durable covering coat for protection of the finish during the transshipment, which shall be capable being peeled off after installation. Additionally, a small quantity of finished paint shall be supplied with each Consignment of the Panel to enable the purchaser's Store at Site for any finish which may get damaged during the transshipment.</p>																		
8.0	<p>WIRING :</p>																		

	All wiring shall be carried out with 1100 volts grade single core, multi strand flexible tinned copper wires with PVC insulation. The conductor size shall be 2.5 sq. mm.(minimum). Wiring troughs shall be used for routing the cables. Wire numberings and colour code for wiring shall be as per IS IS:5578/1984. The wiring should be cased in suitable width PVC casing. The wiring diagram for various schematics shall be made on thick and durable white paper in permanent black ink and same should be encased in plastic cover thermally sealed. It should be kept visibly in a pocket of size 350 x 400 mm of MS sheet of 1 mm thickness, on the interior surface.
8.1	<p>a) All internal wiring shall be securely supported, neatly arranged, readily accessible and connected to equipment terminals and terminal blocks. Wiring gutters & trough shall be used for this purpose.</p> <p>b) Longitudinal troughs extending throughout the full length of the panel shall be used for inter panel wiring. Inter connections to adjacent panels shall be brought out to a separate set of terminal blocks located near the slot or holes meant for taking the interconnecting wires. All bus wiring for inter panel connection shall preferably be provided near the top of the panels running through out the entire length of the panels.</p> <p>c) Wiring connected to the space heaters in the cubicles shall have porcelain beaded insulation over a safe length from the heater terminals.</p> <p>d) Wire termination shall be made with solder less crimping type and tinned copper lugs which firmly grip the conductor and insulation. Insulated sleeves shall be provided at all the wire terminations. Engraved core identification plastic ferrules marked to correspond with panel wiring diagram shall be fitted at both ends of each wire. Ferrules shall fit tightly on the wire and shall not fall off when the wire is disconnected for any purpose. Termination shall be such that no strand of a conductor shall left loose or overhanging. Conductor termination shall be secured to the holding nuts/screws, terminal blocks etc. with washers interposed between the terminals/holding nuts/screw heads. The terminals shall be so connected that no conductor ferrule code gets masked due to overlay of conductors.</p> <p>e) All spare contacts of relays shall be wired up to terminal blocks.</p>
8.2	Each wire shall be continuous from end to end and shall not have any joint within itself Individual Wires shall be connected only at the connection terminals or studs of the terminal blocks, meters relays instruments and other switch board devices.
8.3	Terminals Ends of all wires shall be provided with numbered Ferrules suitably coloured for phase identification. At point of inter-connection where a change of number is necessary, duplicate Ferrules shall be provided with the appropriate numbers on the changing end.
8.4	At the terminal connection, washers shall be interposed between terminals, wire terminals and the holding nuts. All holding nuts shall be secured by locking nuts. The connection stud shall project at least 6 mm from the lock nut surface. Wire ends shall be so connected at the terminals studs that no wire terminal number ferruled gets masked due to succeeding connections. All wires shall be suitable for bending to meet the terminal stud at right angles with the stud axis, and they shall not be skewed.
8.5	All studs, nuts, bolt's screws etc. shall be threaded according to the British Standard practice unless purchaser's prior approval to any other practice of threading is obtained. Spare quantities of nuts, lock and washers of all varieties used on the panel board shall be supplied to the extent of 10% of the used quantities.
9.0	TERMINAL BLOCKS :
9.1	Terminal blocks shall be of clip-on design made out of non-trackable insulating material of 1100 V grade. All terminals shall be stud type, with all current carrying and live parts made of tinned plated brass. The studs shall be of min 4 mm dia brass. The washers, nuts, etc. used for terminal connectors shall also be of tinned plated brass.
9.2	The terminal connector/blocks shall be disconnecting type terminal connectors with

	automatic shorting of C.T. secondary terminals shall be provided in CT secondary circuit. All other terminal connectors shall be non-disconnecting type. Terminal should be shock protected in single moulded piece. Terminal block should have screw-locking design to prevent loosening of conductor.
9.3	At least 20% spare terminals shall be provided. All terminals shall be provided with ferrules indelibly marked or numbered and identification shall correspond to the designations on the relevant wiring diagrams. The terminals shall be rated for adequate capacity, which shall not be less than 10 Amps for control circuit. For power circuit it shall not be less than 15 Amps.
10	SPACE HEATERS :
10.1	60W, 230 V, 50 HZ Tubular Space Heaters suitable for connection to the Single Phase A.C. Supply complete with On-Off Switches located at convenient position shall be provided at the bottom of the Switch Board to prevent condemnation of moisture. The Watt loss per Unit surface of heater shall be low enough to keep surface temperature well below sensible heat. The wattage of heater shall be such as to keep 10 deg C above average ambient temp in rainy season but the temp. shall not under any circumstances damage the insulation of the wiring of the panel. Heaters shall be complete with MCB and thermostat.
11.0	DISTRIBUTION AND CONTROL OF AUX. POWER CIRCUIT :
11.1	<p><u>D.C. CIRCUIT</u></p> <p>There shall be only one 110V D.C. for the entire Control and Relay Board fed from a D.C. Distribution Board. A continuous D.C. Bus shall be provided in the Control and Relay Board and D.C. supply for control, protection, indication and supervision of circuit breaker and other equipment shall be off from D.C. bus through a set of 16 Amp. H.R.C. Fuse on positive and negative side. D.C. supply to be teed off shall be distributed within the Panel as below:</p> <ol style="list-style-type: none"> (a) C.B. remote and protection tripping circuit- 1, C.B. local operation and protective relay circuit without any fuse. (b) C.B. remote closing circuit through a 10A HRC Fuse on the positive side only. (c) C.B. remote and protection tripping circuit, TC-2, through 10A fuse both at +ve and –ve side with trip circuit supervision relay. (d) Indication Circuit through a set of 6 Amp. HRC Fuse and link. <p>In addition to the above, one circuit common to the board shall be teed off for an Alarm Annunciation Circuit from the above incomer D.C. Bus through a set of 6 Amps. HRC Fuse and link.</p> <ol style="list-style-type: none"> 1) C.B. remote and protection tripping circuit, TC-1, through 16A fuse both at +ve and –ve side with trip circuit supervision relay. 2) C.B. remote and protection tripping circuit, TC-2, through 16A fuse both at +ve and –ve side with trip circuit supervision relay. 3) C.B. local operation remote closing circuit through a 10 Amp HRC fuse on + ve and –ve side. <p>Protective relay circuits through 6A fuse both at +ve and –ve side with DC supervision relay.</p> <p>Alarm Bus shall be run throughout the Control and Relay Board & Alarm Circuit shall be teed off at each Panel through a set of links.</p> <p>A D.C. operated no-volt auxiliary relay provided with hand reset type reverse flag with inscription —Panel D.C. Faill and two sets of self-reset N/C contact shall be provided at each C&R Panel to supervise the 18 Amp. HRC Fuse, through which D.C. Supply for control, protection and supervision of C.B. and other equipment has been teed off in each panel. One N/C contact shall be used for visual alarm and the other N/C contact shall be used for audible alarm. One Push button having N/C Contact used in Series with the above</p>

	relay for —D.C. Fall Test purpose. Both contacts shall be connected to D.C. Fail Non-Trip Alarm scheme.
11.2	<p><u>A.C. CIRCUITS :</u> 230 Volts, Single Phase A.C. Aux. Supply to the Control and Relay Board will be fed from A.C. Distribution Board through a suitable Fuse Switch Unit provided there. A continuous A.C. Bus shall be provided to the Control and Relay Board where from A.C. Supply to each Panel shall be teed off through a set of links. One 16 Amps. Rated HRC Fuse shall be provided at the Control & Relay Board for the Incoming A.C. Supply. An A.C. operated no volt auxiliary relay rated for 230V are provided with hand reset reverse flag with inscription —A.C. Fail and two sets of self reset N/C Contacts shall be provided in the Panel having common equipment (One N/C contact shall be used in Annunciation Circuit and other N/C contact shall be kept as spare. One push button having N/C Contact used in Series with above relay for —A.C. Fail Test purpose.</p>
11.3	<p><u>P.T. SECONDARY CIRCUIT:</u> There may be two sets bus PT, one in each bus section and one set of PT for feeder. P.T. supply shall be available from either of the two Bus P.T for feeder PT. Two sets of Fuses for phases and link for neutral of suitable rating shall be provided for the Incoming P.T supplies and two sets of 3 nos. LED indicating lamps having coloured top covers for Red, Yellow and Blue phases, shall be provided for supervision of the Fuse. Lamps shall be connected between respective phases and neutral. The arrangement of distribution of P.T. Secondary Circuit shall be as follows:</p> <ol style="list-style-type: none"> Potential supply to the protective relay circuit for Feeder where necessary shall be fed from respective Bus P.T. supply bus. Potential supply to meters, Energy meters and indicating instrument of each panel shall be fed from respective Bus P.T. supply bus. Selected V.T. secondary supply to the protective relays of each panel shall be fed through 3 pole - MCB and link in neutral in each panel where necessary with annunciation contact . Selected V.T. secondary supply to metering and indicating instruments of each panel shall be fed through fuse in each phase and link in neutral in each panel of 132kV/33KV system voltage. Two position (PT-1/PT-2), minimum 4(four) way PT selector switch (stay put type), minimum 16A rating shall be provided in each panel for metering ckt. Additional 4 way in PT selector switch is required for protection wherever applicable. The no. of way may increase during detailed engineering.
12.0	<p><u>MIMIC DIAGRAMS:</u> Mimic diagram formed from strip of suitable materials about 10mm wide with symbols and engraved name plates shall be provided on the exterior of the front panels to represent the single line arrangement of the sub-station. The mimic bus colour shall be subject to purchaser's approval. The mimic diagram shall incorporate the control switches of the transformer CBs semaphore/feeder CBs semaphore, semaphore for earthing switches, isolators, symbols of transformer, etc. However, the bus arrangement is to be confirmed by the Supplier at the time of detail engineering.</p>
13.0	<p><u>CONTROL SWITCH: PISTOL GRIP TYPE:</u> Control Switches for Circuit Breakers shall be of three position spring return type with pistol grip handle and sequence device to ensure that manual pumping of closing solenoid not possible. The switches shall be robust construction and shall have four effective contact positions. "At after Close" position the switches shall have a maintained contact for using with Circuit Breaker Auto-Trip Indication Lamp Circuit.</p>
13.1	<p><u>INDICATING LAMPS:</u></p>

	L.E.D. Type Indicating Lamps shall be provided on the Control Panel to indicate the following:			
	Sl.No.	Functions	Quantity	Colour of Lamp
	1.	C.B. Spring charged indication	1 No.	Blue
	2.	C.B. Trip Circuit healthy indication	1 No.	White
	3.	C.B. Auto tripped indication (where necessary)	1 No.	Amber
	4.	Panel D.C. Fail indication (For common Equipment panel)	1 No.	Amber
	5.	P.T. Supply indicating Lamp (where necessary)	2 sets	Red/Yellow/Blue
	6.	C.B. "ON" indication	1 No.	Red
	7.	C.B. "OFF" indication	1 No.	Green
	8.	Isolator "ON" indication	2 Nos.	Red
	9.	Isolator "OFF" indication	2 Nos.	Green
	10.	C.B. Gas Pressure Low indication	1 No.	Violet
13.1	No indicating lamps under (1) & (2) shall be provided with push button control. All the lamps shall be connected to the auxiliary D.C. supply of the Sub-Station except Sl. No. (4) & Sl. No. (5) which should be connected to the auxiliary A.C. supply and P.T. Secondary supply respectively. The Lamp shall be suitable for Switch Board purpose and shall be Low Watt consumption. The Lamps shall be of cluster LED type of normal colour, this shall be provided with screwed coloured glass covers made translucent to diffuse light. The Lamps should be provided with suitable series resistance. In the initial supply 20% of the lamps actually used on the Switch Board and 10% of the lamps covers used shall be supplied in excess to serve as spares.			
14	<p><u>TEST BLOCKS:</u></p> <p>1. Terminal Blocks for D.C. Circuit and C.T., P.T. & A.C. Circuit should be located on the front side.</p> <p>2. Switch Board Type, back connected test terminal blocks with contacts shall be provided with Link type shorting terminals of C.T. leads before interrupting the normal circuit for injection from an external source, or for inserting testing instruments in the circuit without causing open circuit of the C.T. The potential testing studs shall preferably be housed in narrow recesses of the block moulding insulation to prevent accidental short circuit across the studs. All Test Terminal Block for meters, relays etc. shall be placed as close to the respective equipment as possible.</p> <p>3. 3-Phase, 4-Wire Link type Test Terminal Block having sealing provision shall be provided in Metering Circuit of each Panel.</p>			
15	<p><u>NAME OF IDENTITY PLATES:</u></p> <p>1. All instruments, relays and such other similar electrical devices mounted on the Control Panels shall be provided with Name Plates bearing the Manufacturer's Name, Serial Number and the Electrical Rating Data.</p> <p>2. 10mm. wide plastic plates bearing suitable identification marks shall be fixed under the terminal wiring at the test blocks, at the Fuse Blocks and at the Cable Terminals. Similar Plate shall be fixed on the exterior of the Switch Board in appropriate places to indicate functions of Control Switches, push buttons and equipment numbers etc. Suitable identification marks shall be provided for relays and other instruments. Plates should be screwed and riveted to the Panel Board.</p> <p>3. 50 mm. wide brass or plastic plates shall be provided in order to enable the purchaser</p>			

	<p>to engrave suitable circuit description in 30 mm. size letters for each circuit and mounted in a sheet on the top of each Panel. These plates shall be removable type.</p> <p>4. SCHEMATIC DIAGRAM OF CT,PT,CB CIRCUITRY & AC,DC CKT, IND and ANNUN CKT ALONG WITH PROTECTION CIRCUITRY GIVING THE TERMINAL NOS AND BUSWIRE DETAILS SHALL BE PRINTED IN DURABLE STICKERS AND PASTED INSIDE THE PANEL DOOR PAGE WISE OF THE RESPECTIVE PANEL.</p>
16	<p><u>SAFETY EARTHING:</u></p> <p>1. Earthing of metallic parts or metallic bodies of the equipment on the Switch Board shall be done with soft drawn single conductor bare Copper Tail connections shall have minimum area of 16 sq, mm. and the main earthing connection 60 sq.mm. These wires shall be connected by suitable terminals and clamps junction. Soldered connections shall not be employed.</p> <p>2. The neutral point of star connected LV winding of instrument transformers and one corner of the open delta connected LV side of instrument transformers shall be similarly earthed by tail connected with main earth wire of Switch Board Earthing System. Multiple earthing of any instrument transformer circuit shall be avoided.</p>
17	<p><u>PANEL BOARD LIGHTING:</u></p> <p>01 The Panel Board interior shall be illuminated by CFL lamps connected to 230 Volt Single Phase A.C. The illumination of the interior shall be free from shadows and shall be planned to avoid any strain or fatigue to the wireman likely to be caused due to sub-normal or non-uniform illumination. One emergency D.C. light shall be provided for each panel with individual switch with proper identification mark.</p> <p>02 A toggle switch or door operated switch shall be provided for control of A.C. lighting in each panel.</p> <p>03 One combined 15 Amps. 3-Pin and 5 Amps. 2-Pin Power Socket outlet together with Plus Pins shall be provided at convenient points in each Panel Board for A.C. Supply.</p>
18	<p><u>ANNUNCIATOR:</u></p> <p><u>ELECTRONIC ANNUNCIATOR</u></p> <p>01 Suitable Multi-way (Minm. 12 (Twelve) way for feeder and 16 (Sixteen) way for Tr. Panel, this may increase according to scheme requirement during detailed engineering.) Microprocessor based electronic annunciator shall be provided in each panel to indicate over current and earth fault protection operated. In addition to above, each electronic annunciator of Transformer Control Panel shall have provision to indicate Transformer trouble trip/alarm function operated. Also one window of the Annunciator shall have to be used for Non-Trip A.C. Fail Alarm Indication and one window for Trip Circuit unhealthy indication. Each Electronic Annunciator shall have provision for connection with accept/reset/lamp test/mute Push buttons for proper functions. Electronic annunciator shall have provision for connection with Electronic Buzzer/Electronic Bell for Trip & Non-Trip Audio Alarm of common annunciation scheme. Electronic Annunciation shall have provision for flushing illuminating display with inscription for operation of respective Protection Relay. The Micro-Processor based Electronic Annunciator should have separate coloured windows for Trip & Non-Trip Annunciation for easy detection. Electronic Annunciator shall have first Fault Indication Facilities & System Watch Dog. The MAKE of Annunciators shall preferably be of ‘ALAN’, ‘INSTALARM’ and ‘MINILEC’ make.</p> <p><u>ALARM SCHEMES</u></p> <p><u>TRIP & NON-TRIP ALARM SCHEMES:</u></p> <p>Each Control & Relay Board assembly shall be provided with one Multi way Micro-processor based Electronic Annunciator for Trip Alarm & Non-Trip Alarm. The Alarm Scheme shall comprise of separate D.C. operated common buzzer/alarm bell mounted inside the panel for Trip Alarm & another for Non-Trip Alarm. The wiring shall be such that single</p>

	<p>set of buzzer/bell will be sufficient and cover in common with all the alarm actuating device. Alarm Scheme shall have facility for bell and shall be suitable for self reset as well as hand reset type initiating contact. The alarm Scheme operative as above shall be considered to be within the scope of the Tender.</p> <p>03 <u>PANEL D.C. FAIL ALARM SCHEME</u></p> <p>Control & Relay Panel Board shall have a common — “Panel D.C. Fail” Alarm Scheme operated by 230 V Single phase A.C. Aux. Supply for audible as well as visual alarm in case of failure of D.C. incoming supply to the Board.. The Scheme shall comprise of 2 nos. single element Aux. Relays. One number having a reverse flag with inscription — “Panel D.C. Fail” with 2 nos. self-reset type N/C contacts. Another Single Element Relay without Flag and 1 no. self-reset type N/O & 1 no. N/C contact having inscription —Panel D.C. fail alarm accept Relay’. Besides above 1 no. Indicating Lamp 1 no. A.C. Operated Electric Hooter and 2 nos. Push Button, one having 1 no. N/C contact other having 1 no. N/O contact shall also be provided for successful operation of the scheme. All auxiliary relays required to render Annunciation System operative and shall be considered to be within the scope of the tender. AC fail DC fail scheme shall be operated by relay not contactor.</p>
<p>19</p>	<p><u>INDICATING INSTRUMENT AND METERS:</u></p> <p>01 All instruments shall be Switch Board Type, back connected suitable for semi-flush mounting and provided with dust tight cases for tropical use with dull black enamel finish. All fixing screws, nuts and threaded parts shall be designed to Indian Standards. The dials shall be made of such materials as to ensure freedom from warping, fading, discoloring etc. during full life of instruments. Marking of Scale shall be black on white background. Spring controlled instruments shall be provided with front-of board. Zero adjuster capable of being safely handled while the instrument is in service. The adjustments above mark and below the zero point shall not be less than 3% of the full scale length and need not exceed 6%. It shall have sufficient friction to keep the adjustment in position.</p> <p>All instruments shall have a practicable laboratory means of adjustment of accuracy. The limits of error shall be of class 0.2 type. The calibration of the instruments shall function satisfactorily when mounted on steel panels or alternatively magnetically shielded instruments shall be used.</p> <p>Instruments shall be capable of indicating freely when operated continuous at any temperature from 0 to 50 degree C.</p> <p>All circuits of instruments shall be capable of withstanding applied load of 20% greater than the rated capacity for a period of eight hours.</p> <p>The instruments shall be capable of withstanding the effect of shock vibration and a dielectric test of 2000 Volts r.m.s. to ground for one minute as per relevant ISS.</p> <p>02 <u>Ammeters:</u></p> <p>All ammeters shall be multi-range type digital meters programmable at site depending on CT ratio to indicate direct reading. The operating current value shall be 1A/5A selectable. The ammeters shall be connected to measuring C.T. Core. Ammeters shall be provided one in each phase. Ammeter shall be of 96 mm sq. Auxiliary Supply voltage = 110VAC/110VDC. The make of Ammeters shall be preferably of AE make.</p> <p>03 <u>Voltmeters:</u></p> <p>All Volt Meters shall be mulri-range (132-66-33kV) digital meters programmable at site depending on PT ratio to indicate direct reading. The Volt Meters shall be of 96 mm sq. and operating voltage 63.5/110V. Auxiliary Supply voltage = 110VAC/110VDC. The make of Voltmeters shall be preferably of AE make.</p> <p>04 <u>MW meters:</u></p> <p>All MW meters shall be provided with direct reading scale. The Operating current value shall be 1A/5A selectable and the actual CT& PT ratio shall be programmable at site. The meter shall be of 96 mmsq. Auxiliary supply voltage = 110VAC/110VDC. The make of</p>

the instrument shall be preferably of AE make.

05 PF meters:

The PF meter shall be of single phase or three phase single current type with operating current A1/5A selectable. The Operating voltage shall be 63.5V/110V. The meter shall be 96 mm sq. with a working range of 0.1Lag-1-0.1 lead. The make of the instrument shall be preferably of AE make.

06 Frequency meters:

The frequency meters shall be of Electronic / Digital type with Operating voltage of 110V. The sampling rate shall be 3 samples/sec and the response time shall be less than 3 samples/Sec. The make of the instrument shall be preferably of AE make.

07 Energy Meters:

Three element Tri-vector Meters with MDI projected mounting type shall be provided in the Panels. The Trivector meters shall be of SECURE make Premium 300, Type:- E3M024, accuracy class 0.2S.

20 RELAYS :

20.1 Relays - General requirements

Protective relays shall comply generally with the requirements of IS 3231, IS 8686, IEC 60255 or BS 142 or other approved standards and shall be contained in dustproof flush mounted cases with transparent fronts and semi gloss bezels. The minimum mounting height of relays shall be such that it provides easy viewing/resetting of relay flag indications, easy checking and maintenance of relays, but shall not be less than 600 mm from the floor level in any case.

The relays shall be of the withdrawable and modern numerical type with substantial field experience. Static relays will only be considered where a particular type/field proven numerical relay is not available. In case of solid state and microprocessor based relays, steps shall be taken to protect the relay circuitry from externally impressed transient voltages which could reach the circuitry via connections to instrument transformers or to the section dc systems.

Separate test facilities by means of front test sockets shall be provided for each current and voltage transformer secondary circuit so as to give access for testing of protective relays, meters and associated circuits. This requirement is additional to any permanently connected injection test scheme or locally mounted CT/VT test links.

If any form of modern modular numerical relays or systems are provided, for which specialised test blocks or test plugs are available, these should be provided for each complete relay or scheme. If any other specialized test blocks are required to obviate any disturbance to external wiring during testing, monitoring of currents or voltages or to enable secondary injection testing to be carried out, these shall also be provided.

Two test plugs to suit each different type of relay case or test socket shall be provided for each switchboard or suite of relay panels. The test plugs shall have terminals for both the relay and wiring side connections, which shall accept both wires and plug connectors, and be complete with lengths of flexible cable for connection to a portable relay test set.

Test facilities shall be provided for testing of signaling schemes between sub-stations. These facilities shall include all features necessary to permit testing with feeder in service, with minimum risk of unwanted tripping.

Auxiliary relays shall also be mounted in dustproof cases.

All protective relays shall be provided with a name and data plate to approved standard which shall include auxiliary supply voltage, rated current/voltage, type, make, catalogue No. SI. No. etc.

All metal bases and frames of relays shall be earthed except where the latter must be insulated for special requirements, and an earth terminal shall be provided on the back of the relay case.

Relay equipment incorporating electronic devices shall be arranged to jack-in and have positive means of retaining them correctly in the service position. Equipment incorporating telephone type or other plug in relays should have similar facilities.

Relays which initiate tripping of more than one circuit breaker shall be distinctively coloured and provided with a warning label to avoid incorrect tripping during testing.

All relays which are connected to complete either the tripping circuit of circuit breaker or the coil circuit of an auxiliary tripping relay shall be provided with approved operation indicators.

Indicators shall also be provided on additional relay elements as well enable the phase of the fault condition to be identified.

Each indicator, whether of the electrically operated or mechanically operated kind, shall be capable of being reset by hand without opening the relay case and it shall not be possible to operate the relay when resetting the operating indicator. Each indicator shall be so designed that it cannot show before the relay has completed its operation. Indicators shall not reset during a failure of auxiliary power to the relay.

It shall not be possible to operate any relay by hand without opening the case.

All tripping and intertripping relays shall be of high speed and high burden type.

In order to minimise the effects of electrolysis, operation indicator coils and dc relay operating coils shall be so placed in the circuit that they are not connected to the positive pole of the DC system except through contacts which are normally open and shall wherever possible be continuously connected to the negative pole of the DC system, by use of resistors if necessary.

If bolts or nuts are so placed as to be inaccessible with an ordinary spanner, not less than 2 suitable special spanners shall be provided.

All calculations to determine the adequacy of CT and VT rating shall be submitted to the Authority for approval. In the event that the rating of the VT or CT proposed is insufficient to accommodate the connected burden in accordance with this specification, the supplier shall supply the CT and VT with the necessary increased capacity at no extra cost. All necessary design calculations for CT /VT shall be submitted within two (2) months of Contract award.

The contractor/relay manufacturer shall provide all necessary literature, methods of checking etc. if required for design of CTs/VTs and checking the calculated relay setting of the supplied protection relays. The contractor/manufacturer of the relaying equipment shall arrange, if required, to carry out site tests required for the determination of correct relay and scheme functioning and settings of special protections such as digital feeder differential protection, distance relaying etc. and sufficient advance information shall be given by the contractor in such cases. The contractor shall co-ordinate all such site testing and all test equipment required for site testing and commissioning.

The contractor shall provide only protection relays and equipment, which are supported by guaranteed works" routine test certificates issued by the manufacturers.

The contractor shall provide electrical protection relay data to include manufacturer, type designation, characteristic details and ranges to be used, on per circuit basis.

The use of permanently energised relays shall be kept to a minimum and where approved these shall be of a type having a low burden, to prevent drain on the battery.

Relays associated with the three phases shall be marked with the appropriate phase identification and the fuses and links shall also be suitably labelled. In addition to the labelling to identify relays on the front of panels, all relays and components shall be identified from the rear of the panels.

Test blocks with sufficient number of contacts shall be employed for each relay scheme. Test plugs shall also be supplied at least two numbers for each type. Test blocks shall have sufficient contacts for connecting CT circuits, VT circuits, DC supply, trip circuit, etc. The type of test block to be applied for the protection scheme shall be subject to approval during detail design stage and shall be supplied within the quoted price.

21 MAIN PROTECTION FOR 132kV LINES

21.1 132kV Line Protection:

Main Protection : Numerical distance relay MiCOM P442 shall be provided. Local Breaker Back-up, Auto Reclose and Fault Locator to provide distance of fault in forms of miles / Kilometers / ohms / percentage of line length should be provided if not already incorporated in the relay.

Backup Protection : Numerical O/C & E/F relay MiCOM P127 shall be provided

22. MAIN PROTECTION FOR 132kV TRANSFORMER

Transformer Main Protection : Numerical Transformer Protection relay MiCOM P643 shall be provided. Buchholz, oil level, oil & winding temperature and PRD alarm & trip auxiliary relays shall be provided.

Backup protection : Numerical O/C & E/F relay MiCOM P127 shall be provided on HV & LV side.

22.1 33kV Line Protection :

Main Protection : Numerical O/C & E/F relay MiCOM P 127 shall be provided.

Backup Protection : Numerical O/C & E/F relay MiCOM P 111 shall be provided.

22.2 33kV Transformer Protection :

Numerical O/C & E/F relay shall be provided on HV side. Buchholz, oil level, oil & winding temperature and PRD alarm & trip auxiliary relays shall be provided.

23 CONTRACT DRAWINGS & LITERATURE :

1. In the event of an order materializing, the Supplier shall be submit four prints of each drawing for approval of the purchaser along with 2 sets of literature as mentioned in the spec.

The Contract drawings shall cover the followings:- (both hard and soft copies).

- (a) Details of construction and dimensions of a cubicle and of the complete Panel Board.
 - (b) Template for foundation and details of Cable Trench and Cable Entry Holes in the Foundation Platform.
 - (c) Elementary diagrams of all controls, metering, protection annunciation and other circuits. All devices shall be numbered according to ASA or international usage, which shall be separately coded.
 - (d) Cabling and wiring diagram of the cubicles and inter-connections between them. Ferrule numbers, device number and grouping for cable take off shall be distinctly shown.
 - (e) Dimensional outline drilling diagram and special mounting arrangement if any, of such type of various devices on the Control Board.
 - (f) Inter-connection diagram between Control Board and C.B. power and instrument transformer etc.
 - (g) Wiring Schedule for Control & Relay Panel.
 - (h) Internal wiring diagram of all devices and elementary wiring diagram of relays where internal wiring is in triplicate. Construction details of switches, terminal blocks and test blocks etc.
 - (i) After approval 10 sets of the final contract drawing for each set of Control & Relay Boards are to be supplied by the contractor. One set reproducible tracing of the above drawings shall also be supplied.
2. In the event of contract being awarded 4 copies with soft copy of the following literatures shall be supplied along with the drawings as mentioned
- (a) Complete Literature describing construction, operation, maintenance, adjustment and rating specifications of all the protective and auxiliary relays, recording instruments, metering instruments and control switches.
 - (b) Literature giving rating data, details and adjustments for calibration of the indicating instruments.
 - (c) Calibration instruments for the metering instruments.
 - (d) List of spare parts, identification number of renewable parts of relays, instruments and switches etc. with the help of which the purchaser will be able to procure spare parts from

the contractor at any subsequent time.

24. Type Test & Routine test Report and credential to be submitted along with tender documents:
- i) The bidder has to furnish the type test report, including functional tests for all protective relays from CPRI/NABL accredited, Govt. recognized Test House carried out within five years .
 - ii) Routine test Report carried out within five years signed by any PSU, reputed power utility etc. for similar type C&R panels (with same type protective and auxiliary relays) along with tender documents
 - iii) Credential for supply& delivery and performance certificate from Power Utilities in India(with same type protective and auxiliary relays) along with tender documents.

25. **TEST at FACTORY :**

The following tests shall be carried out and 6 copies of test certificates shall be submitted for approval. The equipment shall only be dispatched after approval of the test certificates.

1. Checking of wiring of Circuits and the continuity.
2. One minute applied voltage test. All equipment on Panel and small Wiring shall be tested for a withstand voltage of 2000 Volts to earth & between different Voltage Circuits.
3. Insulation resistance of the complete wiring, circuit by circuit with all equipment mounted on the Board before and after H.V. test mentioned under 2 above.
4. Routine tests according to the relevant national standard are on the instruments, relays and other devices.

26. **TEST WITNESS :**

- (a) Tests shall be performed at Manufacturers' Works in presence of purchaser's representative shall be carried out. The Supplier shall give at least 15 (fifteen) days advance notice of the date when the tests are to be carried out.
- (b) Purchaser shall have the right to select any quantity of the item wise offered lot for testing, offered for inspection and in the event of failure in test(s), the purchaser shall have the right to reject the offered equipment(s).
- (c) All Relays, Meters & Annunciators provided in the Control & Relay Panel are to be accepted only after successful hundred percent performances testing at the department's works.

27. **COMMISSIONING AT SITE :**

After successful installation and all necessary pre-Commissioning tests are done at site, the panels will be commissioned by the contractor to the satisfaction of the engineer in-charge of the Sub-Station.

28. **GUARANTEE:**

The Control and Relay Panels along with all the mounted devices and instruments shall be guaranteed for trouble-free operation for a period of 1 (one) calendar year from the date of successful commissioning. The guarantee cover shall be for free rectification/replacement of damaged components/parts by the contractor.

**R&U OF PROTECTION SYSTEMS OF
132kV SUB STATIONS
IN MIZORAM**

UNDER

POWER SYSTER DEVELOPMENT FUND

BID PROPOSAL SHEET

CONTENTS

Sl. No.	Section	Subject
1	Section-I	Bid Form
2	Section-II	Guaranteed Technical Particulars (GTP)
3	Section-III	Price schedules : Schedule-I : Supply Price Schedule-II : Erection Price Schedule-III : Total Price

Section-I

BID Forms (Bid Envelope)

Bid Proposal Ref. No.:

Date:

To

The Engineer-in-Chief,
Power & Electricity Department,
Mizoram, Aizawl - 796001

Subject: R&U of Protection Systems of 132kV Sub Stations in Mizoram under PSDF

Sir,

- 1.0 Having examined the Bidding Documents dated..... the receipt of which is hereby acknowledged, I/we the undersigned, offer to design, manufacture, test, deliver, install and commission (including carrying out trial operation, performance & Guarantee Test as per the provision of Technical Specification) the facilities under the above-named package in full conformity with the said Bidding Documents. We hereby submit our Bid, in Bid envelope i.e. Technical and Financial bid to be opened subsequently.
- 2.0 Attachments to the Bid Form (Bid Envelope) : In line with the requirement of the Bidding Documents, we enclose herewith the following attachments:
 - (a) **Attachment 1:** Bid Security, in a separate envelope, in the form of Bank Draft/Pay Order/Banks certified Cheque for a sum of
(details of Earnest Money shall be mentioned in a separate sheet showing the items to which bid is submitted)
 - (b) **Attachment 2:** Manufacturer's Authorisation Forms - registered/notarized
 - (c) **Attachment 3:** Work Completion Schedule
 - (d) **Attachment 4:** Guarantee Declaration.
 - (f) **Attachment 5:** Declaration for tax exemptions, reductions, allowances or benefits
 - (g) **Attachment 6:** Declaration
- 3.0 We are aware that our Second Envelope is liable to be rejected in case the same contains any deviation/omission from the contractual and commercial conditions and technical Specifications other than those identified in this Bid Envelope.
- 3.1 We are aware that the Price Schedules do not generally give a full description of the Work to be performed under each item and we shall be deemed to have read the Technical Specifications and other sections of the Bidding Documents to ascertain the full scope of Work included in each item while filling-in the rates and prices in price schedule.
- 3.2 We declare that prices quoted by us in the Price Schedules shall be fixed and firm during the execution of Contract.
- 4.0 We confirm that except as otherwise specifically provided our bid prices quoted includes all taxes,

duties, levies and other charges which may be assessed on us by all municipal, state or national government authorities in and outside India.

- 4.1 Service Tax, if applicable, for the services to be rendered by us, the same is included in our bid price quoted.
- 4.2 We confirm that we shall also get registered with the concerned Sales Tax Authorities, in all the states where the project is located.
- 5.0 We have read all the provisions and clauses in the GCC, SCC, ECC & GTC and confirm that they were acceptable to us. Further we understand that deviation taken in any of the above clauses by us may make our bid non-responsive as per provision of bidding documents and be rejected by you.
- 6.0 We undertake, if our bid is accepted, to commence the work immediately upon your Notification of Award to us, and to achieve the delivery of goods and related services within the time stated in the Bidding Documents.
- 7.0 If our bid is accepted, we undertake to provide a Performance Security(ies) in the form and amounts, and within the times specified in the Bidding Documents.
- 8.0 We agree to abide by this bid for a period of twelve (12) months from the date fixed for opening of bids, and it shall remain binding upon us and may be accepted by you at any time before the expiration of that period.
- 9.0 Until a formal Contract is prepared and executed between us, this bid, together with your written acceptance thereof in the form of your Notification of Award shall constitute a binding contract between us.
- 10.0 We understand that you are not bound to accept the lowest or any bid you may receive.
- 11.0 We, hereby, declare that only the persons or firms interested in this proposal as principals are named here and that no other persons or firms other than those mentioned herein have any interest in this proposal or in the Contract to be entered into, if the award is made on us, that this proposal is made without any connection with any other person, firm or party likewise submitting a proposal is in all respects for and in good faith, without collusion or fraud.

Dated this _____ day _____ of 20____

Yours Sincerely,

For and on behalf of the [Name of the Bidder#]
(Signature)
(Printed Name)
(Designation)
(Common Seal)
Business Address:

**(Manufacturer's Authorization Form)
(On Manufacturers Letterhead)**

To:

The Engineer-in-Chief,
Power & Electricity Department,
Mizoram, Aizawl - 796001

Dear Sir,

WE [*Insert: name of Manufacturer*] who are established and reputable manufacturers of [*insert" name and/or description of the plant & equipment*] having production facilities at [*insert: address of factory*] do hereby authorize [*insert: name & address of Bidder*] (hereinafter, the "Bidder") to submit a bid, and subsequently negotiate and sign the Contract with you against NIT [*Insert: title and reference number of NIT*] including the above plant & equipment or other goods produced by us.

We hereby extend our full guarantee and warranty for the above specified plant & equipment materials or other goods offered supporting the supply, installation and achieving of Operational Acceptance of the plant by the Bidder against these Bidding Documents, and duly authorize said Bidder to act on our behalf in fulfilling these guarantee and warranty obligations. We also hereby declare that we and, [*insert: name of the Bidder*] have entered into a formal relationship in which, during the duration of the Contract (including warranty / defects liability) we, the Manufacturer or Producer, will make our technical and engineering staff fully available to the technical and engineering staff of the successful Bidder to assist that Bidder, on a reasonable and best effort basis, in the performance of all its obligations to the Purchaser under the Contract.

For and on behalf of the Manufacturer

Signed:

Date:

In the capacity of [*Insert.' title of position or other appropriate designation*] and this should be signed by a person having the power of attorney to legal bind the manufacturer.

Date:

Place:

(Signature)

(Printed Name)..... ..

Designation)

(Common Seal)

Note 1. The letter of Undertaking should be on the letterhead of the Manufacturer and should be signed by a person competent and having Power of Attorney to legally bind the Manufacturer. It shall be included by the bidder in its bid.

(Work Completion Schedule)

Bidder's Name and Address:

To:

The Engineer-in-Chief,
Power & Electricity Department,
Mizoram, Aizawl - 796001

Dear Sir,

We hereby declare that the following Work Completion Schedule shall be followed by us in furnishing and installation of the subject Package for the period commencing from the effective date of Contract to us:

Sl. No.	Description of work	Period in months from the effective date of Contract
1	Detailed Engineering and drawing submission a) commencement b) completion	
2	Procurement of equipments components & assembly a) commencement b) completion	
3	Manufacturing a) commencement b) completion	
4	Shipments & Delivery a) commencement b) completion	
5	Establishment of site office Installation at Site a) commencement b) completion	
6	Erection a) commencement b) completion	
7	Testing & Pre-commissioning a) commencement b) completion	
8	Trial Operation a) commencement b) completion	

Date:

Place:

(Signature)

(Printed Name)

(Designation).....

(Common Seal)

Note: Bidders to enclose a detailed network covering all the activities to be undertaken for completion of the project indicating key dates for various milestones for each work.

(Guarantee Declaration)

Bidder's Name and Address:

To:

The Engineer-in-Chief,
Power & Electricity Department,
Mizoram, Aizawl - 796001

Dear Sir,

We hereby declare that this Attachment of "Guarantee Declaration" is furnished by us in First Envelope of bid.

Date:

(Signature)

Place:

(Printed Name)

(Designation)

(Common Seal)

(Declaration for tax exemptions, reductions, allowances or benefits)

Bidder's Name and Address:

To:

The Engineer-in-Chief,
Power & Electricity Department,
Mizoram, Aizawl - 796001

Dear Sirs,

We confirm that we are solely responsible for obtaining following tax exemptions, reductions, allowances or benefits in respect of supplies under the subject package, in case of award. We further confirm that we have considered the same in our bid thereby passing on the benefit to _____ (Name of Employer/Purchaser) while quoting our prices. In case of our failure to receive such benefits, partly or fully, for any reason whatsoever, the Employer will not compensate us.

We are furnishing the following information required by the Employer for issue of requisite certificate if and as permitted in terms of the applicable Govt. of India policies/procedures (in case of award):

Applicable Act, Notification No. and Clause Ref. No.	Sl.No.	Description of item on which applicable	Country of origin	Remarks, if any

(The requirements listed above are as per current Notification of Govt. of India indicated above. These may be modified, if necessary, in terms of the Notifications.)

Date:

Place:

Signature)
(Printed Name)
(Designation)
(Common Seal)

(Declaration)

Bidder's Name and Address:

To:

The Engineer-in-Chief,
Power & Electricity Department,
Mizoram, Aizawl - 796001

Dear Sir,

We confirm that Bid Forms and Price Schedules in the Second Envelope have been filled up by us as per the provisions of the Instruction to Bidders. Further, we have noted that the same shall be evaluated as per the provisions of the Bidding Documents.

Further, we hereby confirm that:

- (i) there are no discrepancies/inconsistencies and deviations/omissions/reservations to the Bidding Documents, in the Second Envelope bid;
- (ii) the description of items and the unit thereof in the price schedules in the Second Envelope bid are in conformity with those indicated in the price schedule of the Bidding Documents without any deviation to the specified scope of work.

We also confirm that in case any discrepancies/ inconsistencies and deviations/omissions/reservations, as referred to in para (i) and (ii) above, is observed in the Second Envelope, the same shall be deemed as withdrawn/rectified without any financial implication, whatsoever to _____(Name of Employer/purchaser).

Date:..... ..

Place:

(Signature)

(Printed Name)..... ..

(Designation)..... ..

(Common Seal)..... ..

SECTION-II

GUARANTEED TECHNICAL PARTICULARS

(To be filled in by the Bidder and shall be submitted with Technical Bid)

CONTENTS

1. GTP of 132kV & 33kV Circuit Breakers
2. GTP of 132kV & 33kV Current Transformers
3. GTP of 132kV & 33kV Potential Transformers/Voltage Transformers
4. GTP of 132kV Capacitive Voltage Transformers
5. GTP of 132kV & 33kV Surge Arresters/ Lightning Arrester
6. GTP of 132kV & 33kV Isolator
7. GTP of 132kV & 33kV Control & Relay Panels

Guaranteed Technical Particulars of SF6Circuit Breakers

S. No	Description	Particulars
1.0	Manufacturer's Name & Address of manufacturing plant	
2.0	Type of Construction	
3.0	Type of circuit breaker	
4.0	Standard applicable	
5.0	Principle of operation	
6.0	Rated voltage,kV	
7.0	Reference ambient temperature	
8.0	Continuous current in Ampere a) Reference ambient temperature 40°C b) Reference ambient temperature 50°C	
9.0	Maximum temperature rise over an ambient of 50 °C	
10.0	Short time current rating a) For 1 second b) For 3 second	
11.0	Dynamic peak circuit withstand capacity (kA peak)	
12.0	Operating duty	
13.0	Opening time in millisecond	
14.0	a) Arcing time in ms.At100%/50%/25%/10% of rated breaking current. b) Arc length	
15.0	Interrupting capacity based on duty cycle specified a) Symmetrical (kA) b) Asymmetrical (kA) c) D.C. component d) Asymmetrical factor	
16.0	Re-striking voltage characteristics at a) Symmetrical(kA) b) Asymmetrical (kA) c)D.C. component d) Asymmetrical factor	
17.0	Re-striking voltage characteristics at a) Amplitude factor b) Rate of rise of re-striking voltage (kV/µs) c)First pole to clear factor d) Type of device used, if any to control RRRV	
18.0	Number of breaks in series per pole.	
19.0	Length of contact travel (mm)	
20.0	Total length of break (mm)	
21.0	Rate of contact travel a) Tripping (metre/sec) b) Closing (metre/sec)	
22.0	Rated line charging breaking current (Amps)	
23.0	Rated small inductive breaking current (Amps)	
24.0	Maximum shunt capacitor bank (single bank) breaking current (Amps)	
25.0	Maximum current breaking capacity under normal condition when connected to back to back capacitor bank, Amps	

26.0	a) Type and material of main contact b) Thickness of silver plating (micron)	
27.0	Type & material of arcing contact	
28.0	Contact pressure (N/finger)	
29.0	Insulation level (i) Power frequency voltage withstand for 1 min (kV rms) (ii)Lightening impulse(1.2/50 μ s)voltage withstand (kV peak)	
30.0	Insulation level (i) Power frequency voltage withstand for 1 min (kV rms) (ii)Lightening impulse(1.2/50 μ s)voltage withstand(kVpeak)	
31.0	Radio interference voltage test at 28 kV(μ V)	
32.0	Whether circuit breaker is trip free or fixed trip	
33.0	Type & designation of the drive	
34.0	Rated control voltage for closing coil (V dc)	
35.0	Pick up voltage of the closing coil	
36.0	Power required at i) Rated voltage(W) ii) 85% of rated voltage(W) iii) 110% of rated voltage (W)	
37.0	Type of tripping mechanism	
38.0	i) Total interrupting time measured from instant of trip coil energizing to arc extinction (ms.) ii)Closing time measured from instant of application of power to closing coil up to arcing contact touches (ms) iii) Opening time (switches)	
39.0	Maximum over voltage factor of the circuit breaker when switching off i) Unloaded transformer ii)Loaded transformer	
40.0	Maximum current breaking capacity when switching off asynchronous system (out of phase condition)	
41.0	Number of operations, the circuit breaker is capable of performing without inspection, replacement of contacts, main parts of SF6 gas / vacuum bottles i) At rated current ii) At 50% rated current iii) At rated breaking capacity iv) At 50% rated breaking capacity	
42.0	Creepage distance (mm)	
43.0	Weight of complete breaker including poles, operating Mechanism and structure i) Weight of structure (kg) ii)Weight of operating mechanism(kg) iii) Weight of SF6 gas per breaker (kg) (For exact details submit GA drawing)	
44.0	Impact loading for foundation design (to include dead load And impact value) On opening (Newton) On closing(Newton)	

45.0	Insulator i) Material ii) Type iii) Insulation class iv) 1m in dry power frequency withstand voltage (kVrms.) v) 10 Sec. Wet power frequency withstand voltage(kV rms.) vi) Full wave impulse withstand voltage(kV rms.) vii) Permissible cantilever loading (kg)	
46.0	SF6gas (forSF6breaker only) i) Name of gas ii) Supplier of gas iii) General properties of SF6 gas, Purity (mass in%) a) CF4 b) Air c)Water d) Hydrolytic fluorides (PPM) e) Acidity(PPM.) iv) Equivalent standard v) Storage of gas vi) Thermal characteristics, Specific heat (Joules/kg°C, kcal/kg°C) vii) Sublimation temperature(at 760Torr)°C viii) Breaking temperature (at 2.29 atm)°C ix) Physical properties a) Molecular mass (relative) b) Vapour pressure at20°C c)Critical temperature,°C	
47.0	Whether circuit breaker suitable for 1 or3phase reclosing	
48.0	Minimum dead time (ms)	
49.0	Minimum reclosing time at full rated interrupting capacity (ms)	
50.0	Minimum reclaim time (seconds)	
51.0	Limits of adjustment of dead time	
52.0	Device provided to give alarm and block tripping closing of circuit breaker in case of loss of. (forSF6 Breaker only) a) SF6gas b) Air pressure of operating mechanism	
53.0	Rated pressure (bar at20°C gauge) & limits of pressure	
54.0	Rate of SF6gas leakage (% per annum)	
55.0	Whether the breaker will self-close on low pressure of SF6	
56.0	Pole to pole distance i) Centre to centre ii) Clearance(mm)	
57.0	Maximum pole discrepancy i) Between poles for tripping (ms) ii) Between poles for closing (ms) iii) Between poles for C-O (ms) iv) Spare auxiliary switches provided (nos.)	
58.0	Auxiliary switch contact rating i) Continuous ii) Inductive breaking (Amp) iii) Number of spare contacts	

59.0	Clearance between i) Live part to earth (mm) ii) Live part to base of structure (mm) iii) Terminal to base of structure (mm)	
60.0	Material of operating rods/ levers	
61.0	Permissible humidity for SF6gas (ppm) (for SF6 Breaker only)	
62.0	Refilling period for SF6gas (years) (for SF6 Breaker only)	
63.0	Type and rating of heater	
64.0	Details and ratings of motors	

(Signature of Tenderer)

Name (In block letter)

Stamp

GUARANATEED TECHNICAL PARTICULARS OF 33 kV VACUUM CIRCUIT BREAKERS
(To be filled up by the Bidders)

Sl. No	Description	Particulars
1	Name of Manufacturer & Address	
2	i) Type & Designation and ii) Class of breaker- (C1-M2)	
3	Conforming Standard	
4	Service (Outdoor/Indoor)	
5	Rated Voltage kV (Nominal & Maximum)	
6	Frequency	
7	Insulation Level	
	a) 1.2/50 micro sec. L.I. withstand Voltage (KVp)	
	i) between line terminals and ground parts	
	ii) between terminals with Breaker contacts open	
	b) One minute power frequency withstand KV (rms) for dry & wet conditions	
	i) between line terminals and ground parts	
	ii) between terminals with Breaker contacts open	
8	Rated normal Current Amps. (cms.)	
9	Short time Current rating (KA) for 3 secs	
10	Temperature rise above ambient due to rated Current in main contacts in Deg.C.	
11	Rated operating duty	
12	Short Circuit breaking Current	
13	Asymmetrical breaking Current (including DC component) KA (Rms)	
14	Rated (TRV) for terminal fault	
15	Rated making capacity (KA peak)	
16	Data on Restriking Voltage for 100% 50% and 10% rated capacity	
	a) Amplitude factor	
	b) Phase factor	
	c) RRRV Volts/micro sec	
17	Breaking capacity under phase opposition condition in KA and the recovery voltage over poles in KV	
18	Short time Fault breaking capacity MVA	
19	Line charging current breaking capacity	
	a) line charging current AMP	
	b) Corresponding Over voltage (KV)	
	c) Whether Switching Resistor is provided	
	i) Value of Resistor	
	ii) Time of insertion	
	iii) Thermal Rating of Resistor	
20	Maximum Cable charging current breaking Capacity in Amps. And corresponding over Voltage in kV as observed in Tests.	
21	Maximum shunt capacitor bank switching/breaking capacity in	

	MVA and the over voltage factor	
22	Maximum over voltage in Kilovolts on switching OFF Transformer on low load	
23	Total breaking time in mili seconds measured from The instant of trip circuit energisation	
	a) At 10% breaking capacity	
	b) At 100% breaking capacity	
24	Arcing time (ms)	
	a) At 10% breaking capacity	
	b) At 100% breaking capacity	
25	i) Breaks per pole (No)	
	ii) Length of each break per pole (mm)	
	iii) Length of moving contact travel mm	
	iv) Rate of contact travel (m/sec)	
26	Make time (millisecs.)	
27	Minimum reclosing time at rated interrupting Capacity from the instant of the trip coil energisation (mili secs.)	
28	Minimum dead time for 1 phase & 3 phase reclosing with corresponding limits of adjustment of dead time, if any	
29	Maximum radio interference voltage between 0.5 MHz to 2 MHz with Voltage of 110% of rated rms voltage between phase & ground (Micro-Volt)	
30	Details of manually/motor operated spring charging mechanism	
31	i)Voltage and Power requirement for	
	a) closing coil	
	b) Tripping coil	
	ii) No of Tripping Coil	
32	Make, Country, Type, and other details(no. of operation at full short ckt level, rated current etc) of Vacuum Bottle used in VCB	
33	Weight of Vacuum Circuit Breaker	
34	No. of auxiliary contacts (Spring Charging LS) number of NO and NC shall be mentioned	
	No. of auxiliary spare contacts	
35	Power frequency withstand capability of breaker in open condition at	
	i) Atmospheric Pressure of Air/Zero Vacuum Pressure	
36	Actual opening time (from Trip Coil energisation to contact separation) (ms)	
37	Allowable time limit between breaker per pole (for multibreak type) and between poles (ms)	
38	Actual closing time (from Closing Coil energisation to contact touching (ms)	
39	Whether type tests report submitted in line with spec?	
40	Whether a)Dimensional GA Drawing Cross Sectional	a)
	b)Drawing of interrupting Chamber and c)scheme diagram are	b)

	furnished	c)
41	Whether brochure/ leaflet on Technical data for Vacuum bottle enclosed?	
42	Is there any Technical Deviation from present Specification. If so, have you furnished "Deviation Schedule"?	
43	The Equipment offered are suitable for tropical country like India	
44	Whether agreed to supply one no each of closing coil & tripping coil along with breaker without any extra price.	
45	All the 44 items are properly filled ?	

(Signature of Tenderer)

Name (In block letters)

Stamp.

Guaranteed Technical Particulars of Current Transformers

S/N	Particulars			
1.	Manufacturer's name and country of origin:			
2.	Manufacturer's type, designation and model:			
3.	Current transformers data:	Core-I	Core-II	Core-III
	a. Rated primary current (A):			
	b. Rated secondary current (A):			
	c. Transformation ratio:			
	d. Rated output at 0.9 lagging PF (VA):			
	e. Class of accuracy:			
	f. Accuracy limit factor:			
	g. Knee point voltage (V):			
	h. Excitation current at knee point voltage (mA):			
	i. Secondary limiting voltage:			
	j. Resistance of secondary winding at 75°C(Ω):			
4.	Nominal rated voltage (KV):			
5.	Maximum voltage of operation (KV):			
6.	One second over-current factor (times rated current):			
7.	Short time thermal rating for:			
	a) One second. kA(rms):			
	b) Three seconds kA (rms):			
8.	Rated dynamic current (Peak value):			
9.	Instrument security factor for the winding meant for measurement and metering:			
10.	Rated continuous thermal current and corresponding temperature rise (kA°C):			
11.	Creepage distance (mm):			
12.	One minute power frequency dry withstand test voltage-KV(rms):			
13.	One minute power frequency wet withstand test voltage-KV(rms):			
14.	1.2/50 micro second full wave Impulse withstand test voltage-KV(Peak):			
15.	Weigh to foil per CT (Kg):			
16.	Class of oil:			
17.	Whether pressure relief device provided (Yes/No):			
18.	Total weight per C.T. (Kg):			
19.	Magnetisation curves of C.T. cores supplied with tender and total drawing Nos. attached:			
20.	Overall dimensions (mm x mm x mm):			
21.	Mounting details:			
22.	Shipping dimensions of largest package (mmxmmxmm) :			
23.	Shipping weight of heaviest package (Kg):			
24.	Enclosed copies of test reports etc:			

**GUARANTEED TECHNICAL PARTICULARS for VOLTAGE
TRANSFORMER/POTENTIAL TRANSFORMER**

SN	Particulars	Value		Unit
1	Type			
2	Manufacturers type designation.			
3	Rated primary voltage.			Volts.
4	Number of secondary winding			
5	Rated secondary voltage	Wdg I	Wd II	Volts
6	Rated burden	Wdg I	Wd II	VA
7	Accuracy class	Wdg I	Wd II	
8	Temp rise at 1.2 times rated voltage and rated burden and frequency			⁰ C
9	Rated voltage factor at rated frequency, burden and time			
10	Temperature rise for item 9 above.			⁰ C
11	One minute power frequency withstand test (dry) voltage on primary winding			kV(Rms)
12	One minute power frequency withstand test (wet) voltage on primary winding			kV(Rms)
13	1.2/50 micro second impulse wave withstand test voltage			kV(Peak)
14	One minute power frequency withstands test voltage on secondary winding			kV(Rms)
15	Bushing creepage distance			(mm)
16	Variation in ration and phase angle error for variation in : a) Voltage by 1% b) Frequency by 1 Cycle			
17	Whether corona shield is provided or not			
18	(a) Weight of oil filling. (b) Total weight. (c) Overall dimension. (d) Mounting detail (e) Shipping dimension of largest package			Kg. Kg. mm Kg
19	Enclose copies of test reports etc.			

(Signature of Tenderer)
Name (In block letters)
Stamp.

**GUARANTEED TECHNICAL PARTICULARS OF 132kV CVT
(To be submitted by bidder with the tender)**

S N	Description	Value
1	Name of the Manufacturer	
2	Country of Origin	
3	Manufacturer's type and Designation	
4	Standards Applicable	
5	Type of Installation (Outdoor)	
6	Mounting of tank (bottom)	
7	Rated Primary voltage, kV (rms)	
8	Secondary winding details <div style="display: flex; justify-content: space-around;"> Wdg-1 Wdg-2 </div> i) No. of Secondary Winding ii) Rated Secondary Voltage (V) iii) Rated Burden (VA) iv) Class of Accuracy	
9	Maximum ratio error with % rated burden and 5% normal primary voltage	
10	Maximum phase angle error with % rated burden and 5% normal primary voltage	
11	Temperature rise at 1.1 times rated voltage with rated burden (° C)	
12	Rated voltage factor and time	
13	Impulse withstand test voltage kV(peak)	
14	One minute power frequency withstand test Voltage on primary kV(rms)	
15	One minute power frequency withstand test Voltage on secondary kV(rms)	
16	Capacitance (pF)	
17	Total Creepage distance of the bushing (mm)	
18	Protected Creepage distance of the bushing (mm)	
19	Sealing (Metal Bellow) provided	
20	Quantity of insulating oil (ltrs)	
21	Weight of oil (kg)	
22	Total Weight including oil (kg)	
23	Mounting details	
24	Overall Dimensions	

Signature _____
 NAME: _____
 Designation: _____

Guaranteed Technical Particulars of SURGE ARRESTER

(This Schedule shall be filled in for each category of LA)

S.no	Description	Unit	Particulars
1	Name & Address of Supplier & Manufacturer		
	<input type="checkbox"/> Surge Arrester		
	<input type="checkbox"/> Surge Monitor		
	<input type="checkbox"/> Line Dis-connector		
	<input type="checkbox"/> Metal Oxide Block		
	<input type="checkbox"/> Terminal Clamp		
2	Name & address of collaborator, if any		
3.	Standard to which surge arresters conforms		
4.	Surge Arrester		
4.1	Voltage rating (KV rms)		
4.2	Continuous Operating Voltage (KV rms)		
	a) Continuous Operating Voltage (KV rms)		
	b) Leakage current at continuous operation voltage		
	c) Partial discharge at 1.05 COV (PC)		
	d) Permitted leakage current of arrester beyond which arrester is faulty :		
5.	Frequency (Hz)		
6.	Nominal discharge current (wave shape – 8 / 20 micro second) (KA)		
7.	Pressure relief rated current (KA rms)		
8.	Steep current protection level at 10 KA		
	a) Lighting impulse protection level at 5 KA and 10 KA (KVP)		
	b) Switching impulse protection level with 40 x 80 micro-sec. Wave at 500/1000 A		
9.	Long duration current impulse withstand capacity and virtual duration		
10.	Line discharge class		
11.	Thermal runaway limit of arrester		
12.	Energy capability (kJ/KV)		
13.	Pressure relief rating		
14.	Dry arcing distance		
15.	Reference current and reference voltage		
16.	Arrester housing		
16.1	Power frequency one minute wet withstand voltage (kV rms)		
16.2	Lighting impulse dry withstand voltage (KVP)		
16.3	Creepage distance		
	a) Protected		
	b) Total		
16.4	Short circuit withstand capacity		
16.5	Bending moment (mm)		

17.	Dis-connector		
	a) Constructional Details		
	b) Other information as applicable to surge arrester		
18.	Surge monitor		
	a) Constructional details		
	b) Degree of protection		
19.	Suitable for hot line washing		
20.	Dimension & weight		
21.	G A drawing indicating height of complete unit from base to line, minimum recommended center to center spacing, clearance form ground equipment at various height of arrester, earthing arrester, earthing arrangement on earthed site of arrester etc.		
22.	Details of packing		
23.	Licence number and date for using ISI certification mark if any		
24.	Ammeter for discharge current		
	a) Type & Make		
	b) Accuracy		
	c) Range (mA)		
25.	Residual voltage		
26.	Follow current		
27.	Any other information		

Signature _____

NAME: _____

Designation: _____

Guaranteed Technical Particulars

ISOLATORS

(This Schedule shall be filled in for each category of Isolator)

S No.	Description	Unit	Particulars
1.0	Name of manufacturer and Address		
2.0	Manufacturer's type		
3.0	Standards to which the equipment conforms		
4.0	Frequency (Hz)		
5.0	Rated voltage KV rms)		
6.0	Maximum design voltage at which the isolator can operate (KV rms)		
7.0	Continuous current rating (Amp. Rms)		
8.0	Rated short time current		
	i) for 3 sec. (KV rms)		
	ii) rated peak short time current (KA peak)		
9.0	Current density at the min. cross section of (Amp./Sq.mm)		
	i) Moving blades		
	ii) Terminal pad		
	iii) Contacts		
	iv) Terminal connector		
10.0	Derating factor for specified site conditions		
11.0	Insulation levels		
	i) Dry impulse withstand voltage (KV peak)		
	a) Phase to earth		
	b) Isolating distance		
	ii) Wet power freq. Withstand voltage (KV rms)		
	a) Phase to earth		
	b) Isolating distance		

12.0	Min. clearance in air (mm)		
	i) Center to center distance between poles		
	ii) Between live parts & earth		
	iii) Between poles on one phase		
13.0	Design & construction		
	i) No. of insulators per pole		
	ii) No. of break per pole		
	a) Main switch		
	b) Earth switch		
	iii) Type of opening /closing mechanism		
	iv) Contacts		
	a) Materials & grade		
	b) Thickness of silver plating on contact surface		
	c) Effective cross sectional area (Sq.mm)		
	1) Main switch		
	2) Earth switch		
	d) No. of operations the isolator can make without deterioration of contacts		

Signed and stamped by the tenderer.

GTP OF CONTROL AND RELAYS PANEL
TO BE FILLED UP BY THE BIDDERS

- 1 **Name of Manufacturer:**
- 2 **Country of Origin:**
- 3 **Manufacturer's Type and Designation:**
- 4 **Dimension:**
- 5 **Standards Applicable:**
- 6 **Mounted Devices**

Sl.No.	Description	Make And Country Of Manufacture	Type (Catalogue to be enclosed)	Brief Description, with contact configuration, Input/Output details, characteristics, range, suitability etc. for clear perspective.
A	SURFACE MOUNTING DEVICES			
1	Circuit Level			
2	Mimic Diagram			
3	Circuit Breaker Control Switch Spring return lost motion type			
4	Digital Ammeter			
5	Digital Volt Meters			
6	Digital MW meter			
7	Digital Frequency meter			
8	Trivector Meters			
9	Digital PF meter			
10	Voltmeter Selector Switch 6 way & off position having break before make contact			
11	Test Terminal block suitable for 3 phase 4 wire system with wire rear connecting studs having provision of sealing arrangement			
12	Multi way micro processor based Electronic Annunciator with building-system watchdog first fault indications and red & yellow coloured windows with inscription for Trip & Non Trip Alarm functions			
13	Indicating Lamps led type 63.5 VAC for P.T. Supply indication with cover RED/YELLOW/ BLUE Colours			
14	Indicating Lamp LED type 230 VAC for Panel D.C. Fail Common Indication with cover			

15	Indicating Lamp LED type 110 VDC for CB ON/OFF Auto up Spring Charge Trip Circuit Healthy Gas Pressure Low Indication with RED/GREEN/ AMBER /BLUE/VIOLET Colours			
16	Push Button for Panel DC fail test			
17	Push Button for including AC fail test			
18	Push Button for non trip Panel DC fail Alarm Accept			
19	Push Button for Annunciator Alarm Test / Mute/Accept Reset			
20	Distance Relay			
21	Over current & Earth Fault Relay with instantaneous high set unit			
22	Transformer Protection Relay			
23	Single Element High Speed Tripping Relay with H/R Contact & H/R flag/indication with required numbers of contracts			
24	Two Element 110 V DC Voltage Actuated Auxiliary Relay with HR Contacts & HR/LED Flag/indication for Transformer Internal Trouble functions (a) Buchholz Trip & Winding Temp. Trip function			
	(b) Buchholz Non-Trip & Winding/Oil Temp. Non-Trip Alarm function.			
25	Two Element 110 V DC Voltage Actuated Auxiliary Relay with HR Contacts & HR, Fag indication for (j) Transformer Low Oil Level Alarm function (ii) Pressure release Device Trip function			
26	Single Element 110 V DC Voltage Actuated Auxiliary Relay with self Reset Contact & Reverse Flag indication for Panel DC Supply fail function			
27	Single Element 230V AC Voltage Actuated Auxiliary Relay with self Reset Contacts & Reverse Flag indication for incoming AC Supply fail function			

28	110 V DC Voltage operated Relay for Trip Circuit supervision purpose with self reset contact			
29	Single Element 230V AC Voltage Actuated Auxiliary Relay with self Reset Contacts without Flag indication for panel DC fail Alarm, Accept			
30	Additional Involvement of Single Element 110 V DC Voltage Actuated Auxiliary Relay with self Reset Contacts without Flag for LV side breaker closing blocking function for Transformer's internal fault			
31	Extra Involvement of Auxiliary Relay for not having sufficient contacts to achieve required functions			
32	Common Electronic DC bell/Buzzer Trip & Non-Trip Alarm functions			
33	Common Electronic AC Bell for Panel DC fail Alarm functions			
B	INSIDE MOUNTING DEVICE			
1	230V AC Cubicle illuminating lamp with door operated Switch/Toggle Switch			
2	110 V DC Emergency Lamp with Toggle Switch			
3	230C AC 60W space heater with thermostat & Toggle Switch			
4	15A Double V AC Combined 2/3 pin plug and socket with Switch			
5	15A Double Pole MCB for Incoming AC Supply			
6	Fuse			
7	Links			
8	Board Terminals			
9	Earthing Arrangement			
10	Interposing P.T. for Directional Relay if required			
11	Interposing Universal type CT for Differential Relay if required			
12	Any additional devices that may be provided in the control & relay Panel			

Signed and stamped by the tenderer.

SECTION-III

PRICE SCHEDULES

SCHEDULE-I : SUPPLY OF EQUIPMENTS

					<i>Amount in INR</i>
Group	Description Equipments / Items	Unit	Provisional Qty.	Unit Price (Inclusive of **Taxes & FOT Destination)	Total Supply Price
Sub Station Equipments					
I	132kV CB (3-Pole)	Set	12		
	33kV CB	Set	13		
II	132kV CT (1-Ph)	No	51		
	33kV CT (1-Ph)	No	54		
III	132kV Bus PT (1-Ph)	No	18		
	33kV PT (1-Ph)	No	36		
	132kV line CVT (1-Ph)	No	51		
IV	132kV Surge Arrestor	No	63		
	33kV Surge Arrestor	No	36		
V	132kV 3-Ph Isolator	Set	7		
	33kV 3-Ph Isolator	Set	3		
Control & Relay Panels					
VI	(a) Line 132 kV	Nos.	10		
	(b) Transformer 132 kV	Nos.	8		
	(c) Line 33 kV	Nos.	9		
	(d) Transformer 33 kV	Nos.	7		
** Exclusive of MVAT					

Seal & Signature of Bidder

SCHEDULE-II : ERECTION

							<i>Amount in INR</i>
Group	Description Equipments / Items	Unit	Provisional Qty.	Unit Erection Price	Unit Service Tax	Unit Erection Price including Service Tax	Total Erection Price
Sub Station Equipments							
I	132kV CB (3-Pole)	Set	12				
	33kV CB	Set	13				
II	132kV CT (1-Ph)	No	51				
	33kV CT (1-Ph)	No	54				
III	132kV Bus PT (1-Ph)	No	18				
	33kV PT (1-Ph)	No	36				
	132kV line CVT (1-Ph)	No	51				
IV	132kV Surge Arrestor	No	63				
	33kV Surge Arrestor	No	36				
V	132kV 3-Ph Isolator	Set	7				
	33kV 3-Ph Isolator	Set	3				
Control & Relay Panels							
VI	(a) Line 132 kV	Nos.	10				
	(b) Transformer 132 kV	Nos.	8				
	(c) Line 33 kV	Nos.	9				
	(d) Transformer 33 kV	Nos.	7				

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SCHEDULE-III : TOTAL AMOUNT

						Amount in INR	
Group	Description Equipments / Items	Unit	Provisional Qty.	Total Supply Price	Total Erection Price	Group Total Amount	
						In Figure	In words
Sub Station Equipments							
I	132kV CB (3-Pole)	Set	12				
	33kV CB	Set	13				
II	132kV CT (1-Ph)	No	51				
	33kV CT (1-Ph)	No	54				
III	132kV Bus PT (1-Ph)	No	18				
	33kV PT (1-Ph)	No	36				
	132kV line CVT (1-Ph)	No	51				
IV	132kV Surge Arrestor	No	63				
	33kV Surge Arrestor	No	36				
V	132kV 3-Ph Isolator	Set	7				
	33kV 3-Ph Isolator	Set	3				
Control & Relay Panels							
VI	(a) Line 132 kV	Nos.	10				
	(b) Transformer 132 kV	Nos.	8				
	(d) Line 33 kV	Nos.	9				
	(e) Transformer 33 kV	Nos.	7				

Seal & Signature of Bidder