

**GOVERNMENT OF MIZORAM
POWER AND ELECTRICITY DEPARTMENT
MIZORAM : AIZAWL**



TENDER DOCUMENT

NOTICE INVITING TENDER NO 4 OF 2017-2018

(Vide No. 996/1/17-E-in-C(PD)/9)

**Name of work : Construction of 33 kV S/C line on
D/C tower to connect new 33/11kV Sub-Station at
Saiha.**

2017

Office of the Engineer-in-Chief, P&E Deptt : Aizawl, Mizoram

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SECTION - I

INSTRUCTION TO TENDERERS

1 DEFINITION OF TERMS

In the Contract, the following expressions shall, unless the context otherwise requires, have the meanings, hereby respectively assigned to them.

The '**Contract**' means the Documents duly signed by both the Parties, forming formal Agreement executed between Power & Electricity Department, Govt. of Mizoram, Aizawl and the Tenderer.

'**Contract Price**' shall mean the total sum of financial involvement named in or calculated in accordance with the provisions of the Contract Price.

'**Equipment/Materials**' shall mean and include all Machinery, Apparatus, Materials etc to be provided/supplied under the Contract by the Tenderer

'**F.O.T Price**' shall mean the cost of equipment/materials up to destinations as specified in the Contract. The cost should include GST, Freight, Insurance, any Charges up to destination.

'**General Conditions**' shall mean these General Conditions of Contract.

'**Month**' shall mean a Calendar Month.

'**Owner**' means the Power & Electricity Department, Govt. of Mizoram, Aizawl.

'**Project**' refers to that mentioned under the headings of the Tender Specifications.

'**Purchaser**' shall mean the Engineer-in-Chief, Power & Electricity Department, Govt. of Mizoram, Aizawl.

'**Purchaser's Representatives**' shall mean any Person or Consulting Firm appointed and remunerated by the Purchaser to Supervise, Inspect, Test and Examine Workmanship on the Survey, Supply and erection works.

'**The Tenderer**' shall mean the Tenderer whose Bid has been accepted by the Purchaser and shall include the Tenderer's Executors, Administrators, Successors and permitted assigns approved by Engineer-in-Chief, Power & Electricity Department, Mizoram, Aizawl.

'**The Engineer/Engineer in charge**' shall mean the Engineer appointed by the Purchaser/Owner for the purpose of this Contract.

'Specification' shall mean the specification annexed to or issued with the General Conditions and shall include the Schedules and Drawings attached thereto as well as samples and patterns, if any.

'Ton' or **'Tonne'** used in these specifications shall mean Metric Ton, unless otherwise specified.

'Plant' is any integral part of the works, which has mechanical, electrical, electronic or chemical or biological functions.

'Contract Documents' shall mean the following documents which shall be deemed to form an integral part of this Contract.

- i) Contract Agreement, Instructions to Tenderers and all conditions of contract.
- ii) Tenderer's proposal including the letters or clarifications there to between the Tenderer and the Purchaser prior to award of Contract and
- iii) Equipment Specifications and Drawings. In the event of any conflict between the above mentioned documents, the Contract Agreement shall prevail.

'Works' means the materials and equipments to be supplied and the work to be executed as defined and set out in the specifications and includes all extra Work, Additions, Deletions, Substitutions and Variations ordered by the Engineer in accordance with the provisions of the Contract.

"Tenderer" means the Person, Firm or Corporation tendering for the works and His/Its Executors or Administrators or Successors or Assigns.

'Site' means the land on, under, in or through which the works are to be executed or carried out or such lands as may be agreed between the Owner and the Tenderer as being reasonable and necessary for the carrying out of the work.

'Sub Contractors' used here refer to a Party or Parties having a direct contract with the Tenderer and to whom any part of the Contract has been sublet by the Tenderer with the consent in writing of the Engineer-in-Chief.

'Labourer' shall mean all categories of labour engaged by the Tenderer, his Sub-Tenderers and his piece workers for work in connection with the execution of the work covered by the specifications. All these labourers will be deemed to be employed primarily by the Tenderer.

'Fiscal Year' shall mean a year beginning on 1st April and ending on 31st March in the succeeding year.

'Security Deposit' shall mean all deposits whether in Government Securities, Fixed Deposit Receipts or Bank Guarantees from Nationalized Banks of India, amounts deducted from interim payments or in any other form as specified by the Purchaser pledged to the Owner for due performance of the Contract and shall be adjusted in case of compensations or penalties and which may stand for future either in part or whole as the situation demands.

Letter of Intent means the letter from the Engineer-in-Chief conveying his intention to accept the Bid subject to reservations as may have been stated therein.

Letter of Award/Instruction to Commence means the letter from the Engineer-in-Chief notifying the formal acceptance of the Bid subject to the terms and conditions finally arrived at after conduction/negotiation (if any).

'Manufacturer' used herein refers to the party proposing to design, fabricate and manufacture as specified complete or in part.

'Authorised Representative' of the Owner shall mean any Authorised Officer of the Owner from the level of Junior Engineer and above.

2 Qualifying Requirement

Qualification of a bidder will be based on meeting the minimum criteria specified in below regarding the bidder's technical and financial position as demonstrated by the bidder's responses in Application.

- i) Average Annual Financial Turn over during the immediate last three (3) consecutive financial years should be 100% of the estimated cost for the works.
- ii) The bidder shall provide evidence satisfactory to the Owner of their capability and adequacy of resources to carry out the Contract effectively. Accordingly, bids shall include the following information:
 - (a) Copies of original documents defining the constitutions or legal status, place of registration and principal place of business; written power of attorney of the signatory of the "Applicant" to commit the plant.
 - (b) Firm's credentials including its past experience in executing similar type or works and also the list of ongoing projects.
 - (c) List of plant, machinery, manufacturing and testing facilities
 - (d) List of manpower with qualification and designations

- (e) Quality assurance system with designated quality officer and Nos. of safety officer with PPE (personal protective equipment)
- (f) A Statement from banker indicating various fund based/non fund based limits sanctioned to the bidder and the extent of utilization as on date. Such statement should have been issued not earlier than three months prior to the date of submission of 'Application'. Wherever necessary P&E Deptt. may make queries with the bidder's bankers;
- (g) The complete annual reports together with Audited statement of accounts of the company for last three years preceding the date of submission of the 'Application'.

The Owner may assess the capacity and capability of the Bidder in Qualification Stage, to successfully execute the scope of work covered under the package within stipulated completion period. This assessment shall include

- (i) Document verification
- (ii) Details of works executed, works in hand, anticipated in future & balance capacity available for the present scope of work
- (iii) Details of plant and machinery, manufacturing/testing facilities, safety equipments, manpower and financial resources
- (v) Details of quality system in place
- (vi) Past experience and performance
- (vii) Customer feedback
- (viii) Banker's feedback etc.

P&E Department reserves the right to waive minor deviations if they do not materially affect the capability of the Bidder to perform the contract.

3 Instruction to Bidder

3.1.0: Bid documents can be obtained from Executive Engineer (Design & Monitoring), Office of The Engineer-in-Chief, Power & Electricity Department, Aizawl, e-mail - encdesignncell@gmail.com during working hours against formal request on payment of the cost of Bid Documents by way of Demand Draft from any Reputed Bank in favour of Engineer-in-Chief, Power & Electricity Dept. Payable at 'SBI Dawrpui Branch, Aizawl.'

3.2.0: Notwithstanding anything stated above, P&E Dept. reserves the right to assess the bidder's capability and capacity to perform the contract should the circumstances warrant such assessment necessary in its overall interest.

3.3.0: IT IS IMPERATIVE/MUST FOR EACH BIDDER TO SATISFY HIMSELF COMPLETELY OF ALL LOCAL CONDITIONS AND ASSESS ANY PROBLEMS RELATING TO THE MEANS OF ACCESS TO THE SITE. RIGHT OF WAY SHALL BE THE JOINT RESPONSIBILITY OF SUCCESSFUL BIDDER AND THE DEPARTMENT. A BIDDER SHALL BE DEEMED TO HAVE FULL KNOWLEDGE OF THE SITE (WHETHER HE INSPECTS OR NOT) ONCE THEY SUBMIT THE BID.

3.4.0: P&E Dept. reserves the right to accept or reject any or all the bids without assigning any reason whatsoever. P&E Dept. also reserves the right to pre-pone/postpone the above dates, split and distribute the work among more than one bidder without assigning any reason whatsoever. The bid documents are non-transferable and the cost of bid documents non refundable under any circumstances. P&E Dept. shall not be held responsible for any delay, loss, damage or non-receipt of request for issue of bid documents or bids sent by post.

3.5.0 This NIT in window form as published in newspapers may also be seen on the official website: www.tender.mizoram.gov.in. In case of any discrepancy between the documents downloaded from the website by the prospective bidder and the bidding documents (Hard copy) issued by P&E Dept. Officials, the latter shall prevail.

3.6.0 The tenderer must have documentary proof of license for construction of 33kV level or above within the Mizoram State issue by Electrical Inspectorate, Government of Mizoram.

4 Earnest Money :

The Tenderer shall have to furnish Earnest Money for Rs. 5.3 lakh (Rupees five Lakhs thirty thousand) only 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 cover super-scribing the Tender Specification, Number and Date of opening failing which the Tender will not be opened. Tribal Tenderers are allowed to submit Earnest Money for half the above amount. Manufacturers registered with NSIC, DGT&D and also SSI unit is exempted for payment of Earnest Money provided Registration Certificate is enclosed.

5 Validity

Tender should be kept valid for a period of 30(thirty) Calendar months from the date of opening of Tenders. Validity less than 30(thirty) Calendar months will be liable for rejection.

6 Examination of the Documents

The Tenderer shall examine General Conditions of Contract and 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 Tenderer other than information given to the Tenderer 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. Dated initial should be given by the Tenderer to all corrections, if any, and the Seal stamped on each. Rates should be quoted both in figures and in words as far as practicable.

5.1. Non-Tribal Tenderers should submit the following alongwith their Tenders:

- 1) ISI/BIS Certificate.
- 2) Documents showing past experience.

5.2. Tribal Tenderers should submit :

- 1) House Tax Payee Certificate
- 2) ISI/BIS Certificate which ever applicable.
- 3) Documents showing past experience.

7 Patent Rights, etc

The Tenderer 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 Tenderer, 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.

8 Reservation

The Owner reserves the right to accept or reject, partly or wholly, or all the tenders 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 Conditions will be automatically rejected.

9 Variations - Additions and Omission

- i) The Tenderer shall not modify the materials and equipment except directed in writing by the Purchaser.
- ii) The Purchaser shall have the right to alter, amend, omit or otherwise vary the equipment by notice in writing to the Tenderer. The Tenderer shall carry out such variations except when said variations result on

cost excess of 15% of the Contract Price, in which case the approval of the Purchaser shall be obtained. The amount of such variations shall be determined in accordance with the rate specified in the Contract so far as they may apply and where such rates are not available. These will be mutually agreed between the Purchaser and the Tenderer.

- iii) If the Purchaser shall make variations in any part of the materials and equipment, a reasonable notice shall be given in writing to the Tenderer. In such cases where equipment has already been manufactured or is under manufacture, the Purchaser may consider payment of additional sum to the Tenderer. If in the opinion of the Tenderer such variation is likely to prevent or prejudice the Tenderer 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.

10 Pre-Bid meeting :

The intending bidder or his official representative is invited to attend a pre-bid meeting which will take place at the address, venue, time and date as indicated in the NIT. The purpose of meeting will be to clarify issues and to answer questions on any matter that may be raised at that stage. The intending bidder is requested to submit any questions in writing to the owner not late than one week before the meeting. Minutes of meeting, including the text of the question raised and the response given will be transmitted to the purchaser of the bidding documents. Non-attendance at the pre-bid meeting will not be a cause for disqualification of the bidder.

11 Special Instruction to Bidder :

Please read following instructions carefully before submitting your bid.

1. All the drawings, i.e. elevation, side view, plan, cross sectional view etc., in Soft Copy and manuals in PDF format, for offered item shall be submitted. Also the hard copies as per specification shall be submitted.
2. The bidder shall submit Quality Assurance Plan for manufacturing process and Field Quality Plan with the technical bid.
3. The bidder shall have to submit all the required type test reports for the offered item. However, in the event of partial submission or reports older than specified limit, bidder must submit his confirmation for those type test reports to be submitted in the event of an order, without affecting delivery schedule, before commencement of supply, free of cost. In absence of this confirmation, the evaluation shall be carried out accordingly as non submission of type test reports.
4. The bidder must fill up all the point of GTP for offered items.

5. All the points other than GTP, which are asked to confirm in technical specifications must be submitted separately with the bid.
6. Please note that the evaluation will be carried out on the strength of content of bid only. No further correspondence will be made.
7. One tender per tenderer (i.e. only one tender should be submitted by each tenderer).

SECTION - II GENERAL CONDITIONS OF CONTRACT

1. Scope of the Work

Bidders are requested to visit the site before participating in the tender. Scope of work of the Contract includes Engineering, Supply, Erection, Testing and Commissioning of all materials, equipment and lines such as –

- i) Survey of 33kV line.
- ii) Preparation of Tower schedule.
- iii) Supply and Erection of G.I. lattice tower with stub & template including civil works.
- iv) Stringing of conductors and ground wire.
- v) Erection of insulators & other hardware fittings.
- vi) Earthing of tower.
- vii) Fixing of number plates, Danger plate etc.

The specification covers design, engineering, manufacture, type tests, inspection and testing at manufacturer's works, packing, forwarding and delivery F.O.R destination.

The scope is on the basis of a single/JV Bidder's responsibility, completely covering supply and erection of all the equipment specified under the accompanying Technical Specifications including other services. It will include the following:

- a) A tentative BOQ has been made on Preliminary investigation / survey. However, the Contractor will make detail survey and will supply the materials as per detailed survey/investigation. The BOQ and survey report should be submitted by successful bidder to the purchaser for approval.
- b) Providing Engineering drawings related to foundation details, structural details of line construction work.
- c) Packing and transportation from the manufacturer's works to the site.
- d) Loading, unloading and transportation as required.
- e) Receipt, storage, preservation and conservation of Materials at the site including insurance.
- f) Erection, testing and commissioning of the line.
- g) Performance and guarantee tests on completion of commissioning.

The following items of work are specifically included in the Contractors scope of work unless otherwise specifically brought out.

- a) Land acquisition.
- b) Compensation of trees, crops cutting, right of way etc.

The scope of work shall also include all work incidentals for successful operation and commissioning and handing over of works whether specifically mentioned or not. In general, works are to be carried out by the Contractor in accordance with the stipulations in Conditions of Contract.

2. Manner of Execution

The Project will be executed on turnkey basis. All the Design of tower, foundation, Tower schedule, Tower Profile and its related document should be submitted by the successful bidder for approval prior execution of work.

3. Price

Firm rates for materials should be quoted FOT Destination. Rate should be inclusive of all taxes, duties, insurance, freight, handling charges, etc. For erection, firm rates should be quoted inclusive of all taxes.

4. Terms of Payment

- i) 10% of the total Contract Price shall be paid as mobilization advance against Bank Guarantee of the same amount within 15 days from signing of the Contract Agreement. Balance payment may be as per work done. The advance so paid shall be adjusted by deducting not less than 10% (Ten percent) from each bill to be paid to the Contractor on pro rata basis until the advance amount is adjusted.
- ii) 80% of the cost of materials/equipment will be paid to the Contractor after receipt of the materials/equipment at site in good conditions to the satisfaction of the Engineer. The payment will be made after the materials/equipment have been duly verified by the site Engineer and certification to that effect. Balance 20% will be paid after completion of the work.
- iii) 80% Payment for Erection Works shall be done for works done as per actual measurement on the basis of R.A. Bills to be raised against final construction. Balance 20% Payment shall be made after successful commissioning of the Project.

5. Mode of Payment

Payments shall be made promptly by the Owner at the receipt of the Tenderer's invoice, complete in all respects and supported by the requisite documents and fulfillment of stipulated conditions, if any. All the payment shall be released to the Contractor directly.

All invoices under the Contract shall be raised by the Tenderer on "the Owner" and all payments shall be made to the Contractor by the Owner.

6. Target Date of Completion

The work should be completed within 18 months from the date of signing contract.

7. Extension of Time

If the supply of equipment or erection work is delayed due to any reasons, the Tenderer 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 Tenderer and are accepted as such by the Purchaser, the Completion Date may be extended without Liquidated Damages.

8. Defect Liability Period

“Defect Liability Period” means 12 calendar months after taking over of the line by the Owner.

The Contract shall not be considered completed until a Defects Liability Certificate shall have been signed by the Engineer-in-Charge and delivered to the Contractor stating the date on which the Contractor shall have completed his obligations to execute and complete the Works and remedy any defects there in to the Engineer’s satisfaction. The Defects Liability Certificate shall be given by the Engineer within 28 days after the expiration of the Defects Liability Period, or, if different defects liability periods shall become applicable to different sections or parts of the Permanent Works, the expiration of the latest such period, or as soon thereafter as any works instructed, pursuant to relevant clauses of this Chapter have been completed to the satisfaction of the Engineer-in-Charge.

Notwithstanding the issue of the Defects Liability Certificate, the Tenderer and the Owner shall remain liable for the fulfillment of any obligation incurred under the provisions of the Contract prior to the issue of the Defects Liability Certificate which remains unperformed at the time such Defect Liability Certificate is issued and for the purposes of determining the nature and extent of any such obligation, the Contract shall be deemed to remain in force between the parties.

If it appears to the Engineer or his Representative at any time during construction or reconstructions or prior to the expiry of the Defects Liability Period, as specified or 12 (twelve) calendar months from the certified date of final completion of entire work covered under the Contract, that any work has been executed with unsound, imperfect, or unskilled workmanship or that any materials or articles provided by the Tenderer for execution of the work are unsound or of a quality inferior to that contracted for, or otherwise not in accordance with the Contract or that any defect, shrinkage or other faults in the work arising out of defective or

improper materials or workmanship, the Tenderer shall upon receipt of a notice in writing on that behalf from the Engineer, forthwith rectify or remove or reconstruct the works so specified in whole or in part as the case may be and/or remove that material/articles so specified and provide other proper and suitable materials at his own expense.

9. Completion of the work

The work shall be completed to the entire satisfaction of the Engineer and in accordance with the time mentioned in the Contract. As soon as the work under the Contract is substantially completed as a whole, the Tenderer shall give notice of such substantial completion to the Engineer along with an understanding to complete any outstanding work during the Defects Liability Period. The Engineer, within 30 days or receipt of such notice, shall inspect the work and shall satisfy himself that the Work(s) has been substantially completed in accordance with the provisions of the Contract and then issue to the Contractor a Certificate of Completion indicating the date of completion. Should the Engineer notice that there are defects in the works or the works are not considered to be substantially completed, he shall issue a notice in writing to the Tenderer to rectify/replace the defective work or any part there of or complete the work, as the case may be, within such time as may be notified and after the Tenderer has complied with as aforesaid and gives notice of completion, the Engineer shall inspect the work and issue the Completion Certificate in the same manner as the aforesaid.

No Certificate of Completion shall be issued and no work shall be considered to be completed unless the Tenderer shall have removed from the work site and/or premises all his belongings/temporary arrangements made/brought by him for the purpose of execution of the work and cleared the site and/or premises in all respects and made the whole of the site and/or premises fit for immediate occupation/use to the satisfaction of the Engineer. If the Tenderer fails to comply with the above mentioned requirements on or before the date of completion of the work, the Engineer may, as he thinks fit, at the risk and cost of the Tenderer, fulfill such requirements and remove/dispose off the Tenderer's belongings/temporary arrangements as aforesaid and the Tenderer shall have no claim in this respect except for any sum realized by the sale of the Tenderer's belongings/temporary arrangements, less the cost of fulfilling the said requirements and any other amount that may be due from the Tenderer, should the expenditure on the aforesaid account exceed the amount by sale of such Tenderer's belongings/ temporary arrangements then the Tenderer shall, on the demand of the Engineer, pay the amount of such excess expenditure.

10. Taking over

- i) The work shall be taken over from the Tenderer by the Owner after he successfully commissioned.
- (ii) The issuance of a Taking over Certificate shall in no way relieve the Tenderer of his responsibility for the satisfactory operation of the line in terms of the specifications.

11. Insurance of Equipment

The materials shall be fully insured by the Tenderer against damage, lost, pilferage etc in transit. Insurance Document should be sent along with evidence of dispatch.

12. Replacement

If the materials/equipments or any portion thereof is damaged or lost before taking over of the work by the Owner, the replacement of such materials/equipment shall be effected by the Tenderer within a specified time to avoid unnecessary delay in the commissioning of the materials and equipment. The replacement of materials/equipment damaged shall be made free of cost by the Tenderer.

13. Rejection

In the event that any portion of the works carried out by the Tenderer is found below standard or otherwise not in conformity with the requirements of the Contract Specifications, the Purchaser shall request the Tenderer in writing to rectify the same. The Tenderer on receipt of such notification shall rectify the work free of cost to the Purchaser. If the Tenderer fails to do so, the Purchaser may:

- a) at its option replace or rectify such defective work and recover the extra cost so involved from the Tenderer plus 15% of the defective work
- b) terminate the Contract.

14. Inspection & Testing During Manufacture

- i) The Purchaser's representative shall be entitled at all reasonable times during manufacture to inspect, examine and test on the Tenderer's premises the material, manpower and workmanship of all equipment to be supplied under this Contract by the Tenderer and if part of the said equipment is being manufactured on other premise, the Tenderer shall obtain for the Purchaser's representative permission to, inspect, examine, and test as if the equipment were being manufactured on the Tenderer's premises. Such inspection, examination and testing shall not release the Tenderer from his obligations under this Contract.

- ii) The Tenderer shall give the Purchaser's Representative thirty (30) days notice in writing of the date and the place at which the materials and equipment will be ready for testing.
- iii) Inspection and Testing will be at the cost of Tenderer including providing assistance for labour, materials, electricity, fuel and instrument as may be required or as may be reasonably demanded by the Purchaser's Representative to carry out such tests efficiently.
- iv) When the materials has passed the specified tests, the Purchaser's Representative shall furnish a Certificate to his effect in writing to the Tenderer. The Tenderer shall provide reasonable copies of the Test Certificates to the Purchaser.

15. Guarantee

The Tenderer shall provide cover of Guarantee to the materials and equipment supplied for a period of 12 (twelve) months from the date of commissioning of the materials/equipments. During the period of Guarantee the Tenderer shall remedy, at his expense, all defects in design, materials and workmanship that may develop under normal use of the materials and equipment upon written notice from the Purchaser who shall indicate in what respect the equipment is fault. The provision of this Clause including the cost of transport shall be implemented within the period specified by the Purchaser at the Tenderer's expense.

16. Force Majeure

The term '**Force Majeure**' shall herein mean Riots (other than among the Tenderers Employees), Civil Commotion (to the extent not Insurable), War (whether declared or not), Invasion, Act of Foreign Enemies, Hostilities, Civil War, Rebellion, Revolution, Insurrection, Military or Usurped Power, Damage from Aircraft, Nuclear Fission, such as Earthquake (above 7 Magnitude on Richter Scale), Lightning, Unprecedented Floods, Fires not caused by Tenderer's negligence and other such causes over which the Tenderer has no control and are accepted as such by the Purchaser, whose decision shall be final and binding.

In the event of either party being rendered unable by Force Majeure to perform any obligation required to be performed by them under this Contract, the relative obligation of the Party effected by such Force majeure shall be treated as suspended for the period during which such Force Majeure cause lasts, provided the Party alleging that it has been rendered unable as aforesaid, thereby shall notify within 10 days of the alleged beginning and ending thereof giving full particulars and satisfactory

evidence in support of such cause. The Purchaser shall verify the facts and grant such extension or as the case may be as fact justify.

17. Payment due from the Tenderer

All cost and damages for which the Tenderer is liable to the Purchaser including a recovery of advance will be deducted by the Purchaser from any money due to the Tenderer under the Contract.

If for any unavoidable reasons, payment is delayed, the Tenderer shall neither charge any interest for the delay in payment nor the Tenderer shall stop the contract work on account of this.

18. Performance Bond or Bank Guarantee for Security

At the time of signing the Contract, the Tenderer shall provide the Purchaser with Security Deposit for a Performance Bond or a Performance Bank Guarantee for an amount of 5% (five percent) of the total accepted value of the works. This Bond or Guarantee will be released at the end of the Guarantee Period and on written request by the Tenderer. Form of Bank Guarantee attached.

19. Delay in Completion

If the Tenderer shall fail to complete the work within the time specified in the Contract Agreement or extension of time without Liquidated Damage, the Purchaser shall recover from the Tenderer as liquidated damages a sum of one half of one percent (0.5 %) of the Balance Contract Value, for each week (7 days) of delay from the expiry of Scheduled Date of Completion. The total Liquidated Damages shall not exceed 10% (ten percent) of the balance contract value to be finalized by the purchaser.

20. Tenderer's Default & Liability

- i) The Purchaser may upon written notice of default to the Tenderer terminate the Contract in circumstances detailed here under:
 - a) If in the judgement of the Purchaser, the Tenderer fails to complete the work within the time specified in the contract agreement or within the period for which extension has been granted by the Purchaser to the Tenderer.
 - b) If in the judgement of the Purchaser, the Tenderer fails to comply with any of the other provisions of the Contract.
- ii) In the event the Purchaser terminates the Contract in whole or in parts as provided in Clause 21.0, the Purchaser reserves the right to purchase upon such terms and in such a manner as he may deem appropriate, materials and equipment similar to that terminated and the Tenderer will be liable to the Purchaser for any additional costs

for delay as defined in Clause 21.0 of the General Conditions until such reasonable time as may be required for the final supply of equipment.

- iii) If the Contract is terminated as provided in Clause 16.0 the Purchaser in addition to any other rights provided in this Article may require the Tenderer to transfer title and deliver to the Purchaser under any of the following cases in the manner and as directed by the Purchaser:
 - a) Any completed materials and equipment
 - b) Such partially completed materials and equipment, Drawings, Information and Contract Rights {hereinafter called Manufacturing Material} as the Tenderer has specifically produced or acquired for the performance of the contract as terminated. The purchaser shall pay to the Tenderer the Contract Price for completed materials and equipment delivered to and accepted by the Purchaser and for manufacturing material delivered and accepted.
- iv) In the event the Purchaser does not terminate the Contract as provided in Clause 16.0 the Tenderer shall continue the performance of the Contract, in which case he shall be liable to the Purchaser for liquidated damages for delay as set out in Clause 14.0 until the equipment is accepted.

21. Termination of the Contract

- i) If the Tenderer finds it impracticable to continue operation or if owing to Force Majeure reasons or to any cause beyond his control, the Purchaser finds it impossible to continue operation then prompt notification in writing shall be given by the party affected to the other.
- ii) If the delay or difficulties so caused cannot be expected to cease or become avoidable or if in operations cannot be resumed within 6(six) months then either parties shall have the rights to terminate the Contract upon 10(ten) days written notice to the other. In the event of such termination of the Contract, payment to the Tenderer will be made as follows :
 - a) The Tenderer shall be paid for all materials and equipment approved by the Purchaser's representative and for any other legitimate expenses due to him.

- b) If the Purchaser Terminates the Contract owing to Force Majeure or due to any cause beyond his control, the Tenderer shall additionally be paid for any work done during the said 6 (six) months period including any financial commitment made for the proper performance of the Contract and which are not reasonably defrayed by payments under (a) above.
- c) The Purchaser shall also release all Bond and Guarantees at its disposal except in cases where the total amount for payment made to the Tenderer exceeds the final amount due to him in which case the Tenderer shall refund the excess amount within 60(sixty) days after termination and the Purchaser thereafter shall release all Bonds and Guarantees. Should the Tenderer fail to refund the amounts received in excess within the said period, such amounts shall be deducted from the Bonds or Guarantee provided.
- iii) On Termination of the Contract for any cause the Tenderer shall see to the orderly suspension and termination of operations, with due consideration to the interest of the Purchaser with respect to completion, safeguarding or storing of equipment produced for the performance of the contract and the salvage and resale thereof.

22. The Engineer shall, on such Termination of the Contract, have Powers

- i) To take possession of the site of Work under the Contract as well as the Land/Premises allotted to the Tenderer for his preliminary, enabling and Works and
- ii) To take possession of any Materials, Constructional Plant, Equipment, Implements, Stores, Structures etc thereon.

The Engineer shall also have powers to carry out the incomplete Work by any means or through any other Agency or by himself at the risk and cost of the Tenderer. In such a case, the value of the Work done through such agencies shall be credited to the Tenderer at his Contract prices and the Tenderer shall pay the excess amount, if any incurred in completing the Work as aforesaid as stipulated herein.

22.1. On termination of the Contract in full or in part, the Engineer may direct that a part or whole of such Sub-Station, Equipment and Materials, Structures be removed from the site of the Work as well as from the land/premises allotted to the Tenderer for his preliminary, enabling and ancillary Works, within a stipulated period. If the Tenderer shall fail to do so within the period specified in a notice in writing by the Engineer, the Engineer may cause them to be sold, the

net proceeds of such sale to the credit of which shall be released after completion of Works and settlement of amounts under the Contract.

22.2. If the expenses incurred or to be incurred by the Department for carrying out and completing the incomplete Work or part of the same, as certified by the Engineer, are in excess of the value of the Work credited/to be credited to the Tenderer, the difference shall be paid by the Tenderer to the Department. If the Tenderer fails to pay such an amount, as aforesaid, within thirty days of receipt of notice in writing from the Engineer, the Engineer shall be empowered to recover such amount from any sums due to the Tenderer on any account under this or any other Contract or from his Security Deposit or otherwise.

22.3. Also, the Engineer shall have the right to sale any or all of the Tenderer's unused materials, constructional plant, equipment, implements, temporary building/structures etc. and apply the proceeds of sale thereof towards the satisfaction of any sums due from the Tenderer under the Contract and if thereafter there maybe any balance outstanding from the Tenderer, the Engineer shall have powers to recover the same in accordance with the provisions of the Contract.

22.4. All decisions/actions of the Engineer under this clause as aforesaid shall be conclusive and binding on the Tenderer.

23. Bankruptcy

If the Tenderer shall become Bankrupt or have a receiving order made against him or compound with his Creditors, or being a Corporation commence to be wound up, not being a voluntary winding up for the purpose only of amalgamation or reconstruction, or carry on its business under a receiver for the benefit of its Creditors or any of them the Purchaser shall be at liberty:-

- a) to Terminate the Contract forthwith by notice in writing to the Tenderer or to be liquidator or receiver or to any person in whom the Contract may become vested and to act in the manner provided in Clause 20.0 as though the last mentioned notice has been the notice referred to in such Article and the materials and equipment has been taken out of the Tenderer's hand.
- b) to give such liquidator, receiver, or other person the option of carrying out the contract subject to his providing a guarantee for the due and faithful performance of the contract upto an amount to be determined by the Purchaser.

24. Contingent Fees

The Tenderer warrants that he has not employed any person to solicit or secure the contract upon any agreement for a Commission, Percentage, Brokerage or Contingent Fee, breach of this warranty shall give the Purchaser the right to cancel the Contract or to take any other measure as the Purchaser may deem fit. The warranty does not apply to commissions payable by the Tenderer to Established/Commercial or Selling Agent for the purpose of securing business.

25. Non-Assignment

The Tenderer shall not assign or transfer the contract or any part thereof without the prior approval of the Purchaser.

26. Certificate not to Affect Rights of the Purchaser of the Tenderer

The issuance of any certificate by the Purchaser or any extension of time granted by the Purchaser shall not prejudice the rights of the Purchaser in terms of the contract nor will this relieve the Tenderer of his obligations for due performance of the Contract.

27. Settlement of disputes

- i) Except as otherwise specifically provided in the Contract, all disputes concerning question of fact arising under the Contract shall be decided by the Purchaser subject to a written appeal by the Tenderer to the Purchaser, these decisions shall be final to the Parties hereto.
- ii) Any disputes or differences including those considered as such by only one of the Parties arising out of or in connection with this Contract shall be to the extent possible settled amicably between the Parties. If amicable settlement cannot be reached then all disputes issues shall be settled by Arbitration.

28. Arbitration

- i) If at any time, any question, disputes or difference whatsoever shall arise between the Tenderer and the Purchaser upon or in relation to or in connection with this Contract, either of the Parties may give to the other notice in writing of the existence of such a question dispute or difference and the same shall be referred to two Arbitrators, one to be nominated by the Purchaser and the other to be nominated by the Tenderer or in case of such arbitration not agreeing, then to an Umpire to be appointed by the Arbitrator in writing, before proceeding with the reference and the decision of the Arbitrator or in the event of their not agreeing of the Umpire appointed by them, shall be final and binding on the Parties and the provision of the Indian Arbitration and Conciliation Act, 1996 and of the Rules there under and any statutory modifications thereof shall be deemed to apply and be incorporated in this Contract. Such a notice of the

existence of any question, dispute or difference in connection with this contract shall be served by either party within 90 days of the issue of the Taking Over Certificate by the Purchaser, failing which all rights and claims under this Contract shall be deemed to have been forfeited and absolutely barred.

ii) Upon every or any such reference, the cost of and incidental to the reference and award respectively, shall be at discretion of the Arbitrators or in the event of their not agreeing of the Umpire appointed by them who, may determine the amount thereof or direct the same to be fixed as between solicitor and client, or as between Party, and Party shall direct by whom and to whom and in what manner the same shall be borne and paid.

iii) The work under this Contract shall, if reasonably possible, continue during arbitration proceedings, and no payments due from or payable by the Purchaser shall be withheld on account of such proceedings except to the extent which may be in dispute.

29. Jurisdiction

No legal proceedings shall be taken to enforce any claim and no suit rising out of any conflict shall be instituted except in a court of competent jurisdiction located within **MIZORAM**.

30. Language and Measure

All Documents pertaining to the Contract including Specifications, Schedule, Notice, Correspondence, Operating and Maintenance Instructions, Drawings, or any other writings shall be in English Language. The Metric System of measurement shall be used exclusively in this Contract.

31. Correspondence

- i) Any notice to the Tenderer under terms of the Contract shall be served by registered mail or by hand at the Tenderer's principal place of business.
- ii) Any notice to the Purchaser shall be served at the Purchaser's Principal office in the same manner.

32. Consignee and Paying Authority

| Name of Work | Paying Authority | Consignee |
|--|---|--|
| Construction of 33kV S/C line on D/C tower to connect new 33/11kV Sub-Station at Saiha | Executive Engineer, Saiha Power Division | Sub-Divisional Officer, Saiha Power Sub- Division |

33. Legal Addresses of the Parties

The addresses of the Parties to the Contract are as follows :

Purchaser : The Engineer-in-Chief,
Power & Electricity Department
Govt. of Mizoram, Aizawl.

Tenderer : _____

SECTION - III TECHNICAL SPECIFICATION

TECHNICAL SPECIFICATIONS FOR 33KV DOUBLE CIRCUIT LATTICE TOWER LINE

1 SCOPE :

The scope covers the work Design, Manufacture, Testing before Dispatch, Supply, Delivery FOT Destination and construction of works for 33kV Single Circuit Transmission Line in Double Circuit Tower 6km long to connect new 33kV Sub-Station at Saiha. The supply of all the required materials on TOTAL TURN KEY is in the scope of the contractor. The following works are the scope of works

- (i) The detailed survey to be got conducted including route map, tower schedule, soil investigation reports.
- (ii) The Tower designs to be done and all the BOQ to be frozen
- (iii) The foundation designs to be done for different soil classifications like normal, submerged, hard rock, fissured rock etc and provisional quantities to be indicated in the BOQ.
- (iv) Construction of 33kV S/C line in D/C towers of route length 6 km.
- (v) Stringing of 33kV ACSR Dog conductor for a route length of about 6km.
- (vi) Fitting of Insulators & hardware fittings for 33kV line.
- (vii) Construction of foundation (Civil Work) for the towers.

2 STANDARDS :

The Fabrication, Galvanizing and Testing of Materials used for manufacturing of Towers shall conform to the latest edition of the following standards except where otherwise specified in the specification.

- i) Code of Practice for use of Structural Steel in Overhead Transmission Line Towers - IS:802 (Part-I) 1997 with latest amendments.
- ii) Code of practice for use of Structural Steel in General Building Construction - IS:800 or BS:449 with latest amendments.
- iii) Recommended practice for Hot Dip Galvanising of Iron and Steel - IS:2629 or BS:729 with latest amendments.
- iv) Methods of Testing, Weight, Thickness and Uniformity of Coating on Hot Dip Galvanised Articles - IS:2633 or BS:729 with latest amendments.

The approximate weight of various types of Towers and accessories for Design and Supply are to be given along with:-

- 1) Supporting Drawings of B, C & S Type Towers including Extension Portions.
- 2) Bill of Materials showing sections of each Towers member size of Galvanised Nuts & Bolts, Quantity, Weight etc.

3 DESIGN :

For approval of drawings the following criteria may be considered.

- 3.1. Tower Configuration shall be Lattice type with double upper cross arm, double middle cross arm and double bottom cross arm drawing and bill of material should be approved by the owner.
- 3.2. The 33kV D/C Transmission lines on Tower using ACSR Dog Conductor to be strung in hilly terrain with slope upto and above 50°.
- 3.3. Earth Work in Benching for Foundation to get same level for digging of 4 Pits for Stubs of a Tower may be done for such area having slope of 25° and below only.
- 3.4. **Span :**
a) Normal Ruling Span shall be : 250m
b) Normal Wind Span : 250m
c) Weight Span : 1.5xNormal Span
- 3.5. **Type of Towers :**
B ~ Tangent upto 30° deviation.
C & ~ Tangent upto 60° deviation.
Special
- 3.6. Wind load shall be 100 - 150 KMph (wind speed) should be able to withstand Cyclonic wind conditions.
- 3.7. ACSR 'Dog' Conductor shall be used.
- 3.8. 33 kV, 70 kN Polymer Insulator shall be used.

4 TOWER MEMBERS :

All steel used for Tower members shall be Open Hearth Steel, a High Yield Point and a High Ultimate Tensile Steel Strength. The Contractor may use High Tensile Steel for important members and bracings (supports) if commercial designs are possible as such. In all for the Steel to be used in fabrication of the Towers, it will be the responsibility of the Contractor to verify and ensure that the quality is maintained and that the Steel is free from Scales, Blisters and Laminations of other defects.

5 BOLTS, NUTS, WASHERS ETC :

All Bolts, Nuts & Washer shall be of Tested Class-I Quality Mild Steel conforming to the latest relevant standard.

No bolts less than 16mm dia. shall be used. The length of the Bolts shall be such that the threaded portion does not lie in the Plane of Contact of member. Spring Washers shall be provided for use under every 10% excess Bolts, Nuts and Washers shall be supplied.

6 FABRICATION :

The Tower Structures shall be accurately fabricated to bolt together easily at the site without any undue strains on the Tower members or in the Bolts, otherwise the Tower or part of it shall be rejected.

No angle members shall have the two Legs flanges brought together by closing the angle. The structure shall be designed so that all parts shall be accessible for Inspection and Clearing. Drain Holes shall be provided at all points where pockets or depressions are likely to hold water.

Workmanship and finish shall correspond to the best modern Transmission Line practice. All similar parts shall be made strictly inter changeable. All Steel sections before work is done on them shall be carefully leveled, straightened and made correct by methods, which shall not injure the material used so that when assembled, the adjacent surfaces are in close contact throughout. No rough edges shall be permitted anywhere throughout the work.

7 HOLES :

All the holes in the Tower Members shall be drilled and not punched. The diameter of the Bolt Holes shall not be more than 1.5 mm larger than the diameter of the holes.

8 EARTHING OF TOWERS :

To keep provision in the Towers for Earthing, two holes of required dia. about 50mm apart shall be drilled on each of the Legs of the Towers such that the lower hole is about 350mm above the ground level, clear of the concrete covering, for connecting the Earthing Strip. Pipe Type Earthing shall be made with Bentonite clay at diagonally opposite legs of each locations as per drawing approved by the owner. For locations where felt necessary or more convenient special earthing arrangement shall be made in the form of Counterpoise Earth. The counterpoise earth wire(15m) shall be buried radially outwards from each leg below ground level at a depth of more than 600mm as per drawing approved by the owner

It is intended that in no case the Tower footing resistance exceed 10 Ohms. In place of High Resistivity Soils where the footing resistance exceeds the value of 10 Ohms suitable grounding arrangements should be made to bring down the same within the desired limit by installing more pipe electrode or by using counter poise earthing in addition to pipe earthing..

9 ACCESSORIES :

Each Tower shall be provided with Step Bolts on one of its Legs. The Step Bolts shall be of standard sizes and shall be provided with two Nuts each at one end to prevent the foot from slipping, the Bolts shall be capable of withstanding a shearing load of not less than 135Kgs. The Step Bolts shall not be spaced more than 450mm apart, preferable alternatively fixed to the two sides of the angle (leg member) and shall extend upwards from a height of about 2500mm.

Anti-Climbing Devices with 2 Ply, 14 SWG, G.I. Barbed Wire shall be provided on each foot of the Tower as per standard practice.

Each Tower shall be suitably drilled for fixing at convenient height, one Danger Plate, one Number Plate and three Phase Plate. The Danger, Number and the Phase Plates shall be provided by the Contractor as per relevant IS, and shall be enameled and of approved design.

10 STUB TEMPLATE :

Stub Templates shall be painted with two coats of Red Oxide Zinc Chromate Primer as per relevant IS specification.

11 GALVANIZING AND PAINTING :

Galvanizing and Painting of the various members of the Towers (Structures) shall be done only after all works of Shearing, Sawing, Drilling, Filling, Bending and Matching are completed.

Galvanizing shall be done by the hot dip process as recommended in IS:2629-1966 or other such authoritative standard shall produce a smooth, clean and uniform coating of not less than 610 Gms per m². The preparation for galvanizing process itself must not adversely affect the mechanical properties of the treated materials.

All assembly bolts shall be thoroughly Hot Dip Galvanised after Treading and must be sufficient to allow for the Galvanised Coating, which must not be excessive at the root of the Threads, so that the Nut shall turn easily on the completed bolts without excessive looseness. The Nut Threads shall not be Galvanised but oiled only. The outside surface shall be Galvanised (Shreadizing of other similar process shall not be used). Sample of Galvanised materials shall be supplied to the Galvanizing Tests set out in IS:229 or BS:129 or other such authoritative standard.

The portion of the Stub Angle from 150mm below the plinth level shall be black and the remaining portion shall be Galvanised.

The parts which are to be painted shall be thoroughly cleaned. Two coats of a good quality Primer shall be applied to produce a smooth void less surface before applying one coat of approved quality Aluminium Paint at works. The final coating of Aluminium Paint shall be applied after erection at site.

12 MARKING :

Each individual member of a Tower shall be given Identification Number as shown on the Assembly Drawing for each type of Tower. Each individual member shall be indelibly stamped or punched with the type of Identification Number as shown on the Assembly Drawing. The Identification Letters and Numbers shall be about 20mm high and shall be punched before Galvanizing to such a depth that they remain clearly legible even after Galvanizing. These marks shall always be placed in the same relative position in all members so as to readily traceable.

13 PACKING OF TOWERS & TOWER ACCESSORIES :

The materials shall be boxed or bundle for transport in the following manner :-

- i) Angle shall be packed in bundles securely wrapped four times around at each end and over 900mm with No. 9 SWG Gauge Wire with ends twisted tightly. Gross weight of any bundle shall not exceed approximately 500Kgs and length of individual member 6000mm.
- ii) Cleat Angles, Brackets, Fillet Plates and similar loose piece shall be nested and bolted together in multiples, and securely bind together through holes wrap around at least four times with No. 9 SWG Steel Wire and twisted tightly. Gross weight of each bundle shall not exceed approximately 70Kgs.
- iii) The correct number of Bolts, Nuts and Washers plus 5% excess for each Tower, Cross Arms attachment to Cross Arms etc. shall be packed in heavy gunnery bags accurately tagged in accordance with the contents and number of bags packed in a solid box of 22 mm thick lumber with panelled ends to be securely nailed and further reinforced with 22 x 75 batons around the sides at the ends with 25 m x No. 18 SWG Iron Band stretched entirely around the batons with ends overlapping at least 150mm. Gross weight of each box shall not exceed approximately 70Kgs.

All packings shall be subjected to the approval of the Purchaser of his appointed representatives.

In witness whereof, the Parties aforementioned have executed this Agreement on the Date, Month and Year first shown in the first paragraph of this Agreement.

14 POLYMER DISC INSULATOR :

14.1. General Requirement :

- (i) The composite insulators shall generally conform to latest Standards.
- (ii) The Composite Insulators will be used on lines on which the conductors will be A.A.A. Conductor of size up to 200 sq. mm. and ACSR of any size up to Panther. The insulators should withstand the conductor tension, the reversible wind load as well as the high frequency vibrations due to wind.
- (iii) Bidder must be an indigenous manufacturer and supplier of composite insulators of rating 33 kV or above OR must have developed proven in house technology and manufacturing process for composite insulators of above rating OR possess technical collaboration /association with a manufacturer of composite insulators of rating 33kV or above. The Bidder shall furnish necessary evidence in support of the above along with the bid, which can be in the form of certification from the utilities

concerned, or any other documents to the satisfaction of the owner.

- (iv) Insulator shall be suitable for both the suspension and strain type of load & shall be of tongue & clevis type. The diameter of Composite Insulator shall be less than 200 mm. The center-to-center distance between tongue & clevis shall be max. 550 mm.
- (v) Insulators shall have sheds with good self-cleaning properties. Insulator shed profile, spacing, projection etc. and selection in respect of polluted conditions shall be generally in accordance with the recommendation of IEC-60815/IS: 13134.

14.2. Interchangeability:

The composite insulator together with the tongue & clevis fittings shall be of standard design suitable for use with the hardware of any other indigenous make conforming to relevant standards referred above.

14.3. Technical Description :

Polymeric Insulators shall be designed to meet the high quality, safety and reliability and are capable of withstanding a wide range of environmental conditions.

Polymeric Insulators shall consist of THREE parts, at least two of which are insulating parts:- (a) Core- the internal insulating part (b) Housing- the external insulating part (c) Metal end fittings.

14.4. Core :

It shall be a glass-fiber reinforced epoxy resin rod of high strength (FRP rod). Glass fibers and resin shall be optimized in the FRP rod. Glass fibers shall be Boron free electrically corrosion resistant (ECR) glass fiber or Boron free E-Glass and shall exhibit both high electrical integrity and high resistance to acid corrosion. The matrix of the FRP rod shall be Hydrolysis resistant. The FRP rod shall be manufactured through Pultrusion process. The FRP rod shall be void free.

14.5. Housing :

The FRP rod shall be covered by a seamless sheath of a silicone elastomeric compound or silicone alloy compound of a thickness of 3mm minimum. It shall be one-piece housing using Injection Molding Principle to cover the core. The elastomeric housing shall be designed to provide the necessary creepage distance and protection against environmental influences. Housing shall conform to the requirements of IEC 61109/92-93 with latest amendments.

14.6. Weathershed :

The composite polymer weather sheds made of a silicone elastomeric compound or silicone alloy compound shall be firmly bonded to the sheath, vulcanized to the sheath or molded as part of the sheath and shall be free from imperfections It should protect the FRP rod against environmental influences, external pollution and humidity. The weather sheds should

have silicon content of minimum 30% by weight. The strength of the weather shed to sheath interface shall be greater than the tearing strength of the polymer. The interface, if any, between sheds and sheath (housing) shall be free from voids.

14.7. Metal end fittings:

End fitting transmit the mechanical load to the core. They shall be made of spheroid graphite cast iron, malleable cast iron or forged steel or aluminum alloy. They shall be connected to the rod by means of a controlled compression technique. Metal end fittings shall be suitable for tongue & clevis hardware of respective specified mechanical load and shall be hot dip galvanized after, all fittings have been completed. The material used in fittings shall be corrosion resistant. As the main duty of the end fittings is the transfer of mechanical loads to the core the fittings should be properly attached to the core by a coaxial or hexagonal compression process & should not damage the individual fibers or crack the core. The gap between fitting and sheath shall be sealed by a flexible silicone elastomeric compound or silicone alloy compound sealant. System of attachment of end fitting to the rod shall provide superior sealing performance between housing, i.e. seamless sheath and metal connection. The sealing must be moisture proof. The dimensions of end fittings of insulators shall be in accordance with the standard dimensions stated in IEC: 60120/ IS: 2486 - Part-II /1989.

14.8. Workmanship

All the materials shall be of latest design and conform to the best engineering practices adopted in the high voltage field. Bidders shall offer only such insulators as are guaranteed by them to be satisfactory and suitable for continued good service in power transmission lines.

14.9. The design, manufacturing process and material control at various stages shall be such as to give maximum working load, highest mobility, best resistance to corrosion, good finish and elimination of sharp edges and corners.

The design of the insulators shall be such that stresses due to expansion and contraction in any part of the insulator shall not lead to deterioration.

The core shall be sound and free of cracks and voids that may adversely affect the insulators.

Weather sheds shall be uniform in quality. They shall be clean, sound, smooth and shall be free from defects and excessive flashing at parting lines.

End fittings shall be free from cracks, seams, shrinks, air holes and rough edges. End fittings should be effectively sealed to prevent moisture ingress; effectiveness of sealing system must be supported by test documents. All surfaces of the metal parts shall be perfectly smooth without projecting points or irregularities, which may cause corona. All load bearing surfaces shall be sooth and uniform so as to distribute the loading stresses uniformly.

All ferrous parts shall be hot dip galvanized to give a minimum average coating of zinc equivalent to 610 gm/sq.m. or 87 microm thickness and shall be in accordance with the requirement of IS:4759. the zinc used for galvanizing shall be of purity 99.5% as per IS:4699. The zinc coating shall be uniform, adherent, smooth, reasonably bright continuous and free from imperfections such as flux, ash rust stains, bulky white deposits and blisters. The galvanized metal parts shall be guaranteed to withstand at least four successive dips each lasting for one (1) minute duration under the standard preece test. The galvanizing shall be carried out only after any machining.

14.10. Test and Standard

Insulators offered shall be manufactured with the same configuration & raw materials as used in the insulators for which design & type test reports are submitted. The manufacturer shall submit a certificate for the same. The design & type test reports submitted shall not be more than five years old.

15 ACSR 'DOG' CONDUCTORS

15.1 Standards :

The power conductor shall conform to the following Indian/ International Standards, which shall mean latest revisions, amendments / changes adopted and / or published as on the date of opening of the Tender.

| Sl. No. | Indian Standards | Title | International Standards |
|----------------|------------------------------------|---|--------------------------------|
| 1 | IS : 209 | Specification BS : 3436 for zinc | |
| 2 | IS : 398 Part I to V (As relevant) | Specification IEC : 209 for aluminium BS : 215 conductor for (Part-II) overhead Transmission purpose. | |
| 3 | IS : 1778 | Reels and BS : 1559 Drums for Bare Conductors | |
| 4 | IS : 1521 | Method of Ten-ISO / R 89 site testing of steel wire. | |

| | | | |
|----|-----------|---|------------------------------|
| 5 | IS : 2629 | Recommended practice for Hot dip galvanizing of Iron and Steel. | |
| 6 | IS : 2633 | Method of Testing uniformity of coating of zinc coated articles. | |
| 7 | IS : 4826 | Galvanised coating quoting on round steel wire. | ASTM A - 472 729 BS : 443 |
| 8 | IS : 6745 | Methods of determination of weight of zinc coating of zinc coated iron and steel articles | BS : 443 |
| 9 | IS : 8263 | Method of radio Interference tests on high voltage Insulators | IEC:437 NEMA : 107 CISPR |
| 10 | IS : 1841 | EC grade aluminium rod produced by rolling (Second Revision) | |
| 11 | IS : 5484 | EC grade aluminium rod produced by continuous casting and rolling (first revision) | |

However, in an event where the supplier offers ACSR conductor conforming to standards other than the above, then the salient points of comparison between the standards adopted and the standards quoted herein shall be detailed in relevant schedule with an authenticated

15.2 Principal Parameter :

The details of conductor are tabulated here under :-

| Sl. | Description | Aluminium | Steel |
|-----|-------------------------------|-----------|-------|
| 1 | Number Of Strands – Nos. | 6 | 7 |
| 2 | Diameter – mm. | | |
| | I) Strands | | |
| | a) Nominal | 4.72 | 1.57 |
| | b) Maximum | 4.77 | 1.6 |
| | c) Minimum | 4.67 | 1.54 |
| | II) Overall Conductor | 14.15 | |
| 3 | Cross Sectional Area– Sq. mm. | | |
| | a) Whole Conductor | 118.5 | |
| | b) Each Strand | 17.5 | 1.94 |
| 4 | Laying Of Strands – Nos. | | |

| | | | |
|----|---|-----------------------|-----------------------|
| | a) Center | N.A | 1 |
| | b) First Layer | 6 | 6 |
| 5 | Weight (Excl. Wt. Of Grease) – Kg / | | |
| | a) Whole Conductor | 394 | |
| | b) Strand (At Nominal Dia.) | 47.8 | 15.1 |
| 6 | Calculated D.C. resistance at 20 Deg C - Ohms / Km | | |
| | a) Whole Conductor | 0.2792 | N.A. |
| | b) Strand | 1.65 | |
| 7 | Ultimate Tensile Stress – KN | | |
| | a) Whole Conductor | 32.41 | N.A |
| | b) Strand | | |
| | i) Before | 2.78 | 2.7 |
| | ii) After Stranding | 2.64 | 2.57 |
| 8 | Modulus of Elasticity – | | |
| | a) Kg / Sq. Cm. | 0.8055 x106 | N.A. |
| 9 | Coefficient of linear expansion - per deg. C. | 19.1x10 ⁻⁶ | 11.5x10 ⁻⁶ |
| 10 | Chemical Composition - % | | |
| | a) EC Grade Al. | 99.95 | N.A |
| | b) Copper (Max.) | 0.04 | N.A. |
| | c) Carbon | N.A | 0.50 – 0.85 |
| | d) Manganese | N.A | 0.50 – 1.10 |
| | e) Phosphorous | N.A | Max. 0.035 |
| | f) Sulphur | N.A | Max. 0.045 |
| | g) Silicon | N.A | 0.10 – 0.35 |
| 11 | Resistivity –Ohms Sq.mm /Mtr. | 0.028264 | N.A. |
| 12 | Constant Mass Temp. Coefficient Of resistance – Per°C | 0.004 | N.A. |

| | | | |
|----|-------------|----|----|
| 13 | Lay Ratios | | |
| | i) Maximum | 14 | 28 |
| | ii) Minimum | 10 | 13 |

The ACSR conductor shall be suitable for being installed directly in air supported on suspension insulator strings or anchored through tension insulator strings at the power cross arms of single circuit, double circuit or multi circuit transmission line towers.

The conductor shall therefore be suitable for satisfactory operation under the tropical climatic conditions listed in the relevant clause.

15.3 Physical constants for Hard-drawn Aluminium.

(i) Resistivity :

The resistivity of aluminium depends upon its purity and its physical condition. However as per the specified value of purity in this specification the maximum value permitted is 0.028264 ohm. sq. mm / mtr at 20 Deg. C, and this value shall be used for calculation of the maximum permissible value of resistance. This value may be checked from the measured value of the resistance.

(ii) Density :

At a temperature of 20°C the density of hard drawn aluminium shall be 2.703 g/cm³.

(iii) Constant-Mass Temperature Co-efficient of Resistance

At a temperature of 20°C the constant-mass temperature co-efficient of resistance of hard drawn aluminium measured between two potential points rigidly fixed to the wire, the metal being allowed to expand freely, has been taken as 0.004 per degree celsius.

(iv) Co-efficient of Linear Expansion :

The co-efficient of linear expansion of hard-drawn aluminium at 0°C has been taken as 19.3x10⁻⁶ per °C. This value holds good for all practical purposes over the range of temperature from 0°C to highest safe operating temperature.

15.4 Physical constants for Galvanised steel wires

(i) Density :

At a temperature of 20°C, the density of galvanised steel wire is to be taken as 7.80 g/cm³.

(ii) Co-efficient of Linear Expansion:

In order to obtain uniformity in calculations a value of 11.5 x 10⁻⁶ Per °C may be taken as the value for the co-efficient of Linear Expansion of galvanised steel wires used for the cores of steel-reinforced aluminum conductors.

15.5 **Materials**

The conductors shall be manufactured from EC grade aluminum rods suitably hard-drawn on wire drawing machines. The aluminum rods used shall comply with all the relevant ISS, BSS, or other standards to be specified along with the due justifications.

Galvanised steel wire shall be drawn from high carbon steel rods produced by either acidic or basic open hearth process, electric furnace process or basic oxygen process. All the properties of the steel strands and wires shall conform to the relevant standards.

The zinc used for galvanising shall be electrolytic high grade Zinc not less than 99.95 percent purity. It shall conform to and satisfy all the requirements of relevant ISS, BSS or other Standards to be specified with the due justification. Galvanising has to be done by hot dip galvanising process. Neutral grease may be applied between the layers of wires, however the weight of the same shall be specified and added to the total weight of the conductor

NOTE: Lithium soap grease corresponding to Grade II of IS:7623- 1974 (Specification for lithium soap greases) is suitable for such application.

The bidder should specify the source of raw materials along with the proof of last purchases made. The GETCO may reject the tender of the Bidders whose raw material suppliers are found to be supplying any poor quality or non standard materials, to the GETCO or any other purchaser.

15.6 **Freedon From Defects**

The wires shall be smooth and free from all imperfections such as spills, splits, slag inclusion, die marks, scratches, fittings blow- holes, projections, looseness, overlapping of strands, chipping of aluminium layers etc. and all such other defects which may hamper the mechanical & electrical properties of the conductor as also the installation of the conductor at the site etc. Special care should be taken to keep away dirt, grit etc. during stranding.

15.7 **Wire Sizes**

(i) **Nominal Size And Tolerances**

The aluminium and galvanised steel wires for the stranded conductor covered by this standard and shall be within the tolerances indicated therein. The diameter of the steel wires shall be measured over the zinc coating.

15.8 **Joints In Wires**

(i) **Aluminium Wires**

No joints shall be permitted in the aluminium wires in the outermost layer of the ACSR conductor. Joints in the inner layers are permitted, in addition to those made in the base rod or wire before final drawing, but no two such joints shall be less than 15 mtr. apart in the complete stranded

conductor. Such joints shall be made by cold pressure butt-welding.

NOTE : Joints are not permitted in the outermost layer of the conductor in order to ensure a smooth conductor finish and reduce radio interference levels and corona losses on the extra high voltage lines.

(ii) Galvanised steel wires

There shall be no joints except those in the base rod or wire before final drawing, in steel wires forming the core of the steel-reinforced aluminium conductor.

15.9 Stranding

The wires used in the construction of galvanised steel reinforced aluminium conductor shall before stranding and after stranding shall satisfy all the relevant requirements as per the standards indicated or any other standards with due justification.

The zinc used for galvanising shall be electrolytic high grade Zinc. It shall conform to and satisfy all the requirements of relevant standards indicated or any other standards with due justification. Galvanising shall be done by hot dip galvanising process. Neutral grease may be applied between the layers of wires.

NOTE: Lithium soap grease corresponding to Grade II of IS:7623- 1974 (Specification for lithium soap greases) is suitable for such application.

In all constructions, the successive layers shall have opposite directions of lay, the outermost layer being right-handed. The wires in each layer shall be evenly and closely stranded.

In conductors having multiple layers of aluminium wires, the lay ratio of any aluminium layer shall not be greater than the lay ratio of the aluminium layer immediately beneath it.

15.10 Standard Length

The standard length of the conductor shall be 2000 meter. A tolerance of +/-5% on the standard length shall be permitted. All lengths outside this limit of tolerance shall be treated as random lengths.

Random lengths will be accepted provided no length is less than 95% of the standard length specified and the total quantity of such random lengths shall not be more than 5% of the total quantity ordered.

Bidder shall also indicate the maximum single length, above the standard length, he can manufacture in the guaranteed technical particulars. This is required for special stretches like river crossing etc. The purchaser reserves the right to place orders for the above length to the extent of 50% of the total ordered quantity on the same terms and conditions applicable for the standard lengths during the tendency of the contract

15.11 Test Reports

Test Certificates of test during manufacture shall be maintained by the Bidder. These shall be produced for verification as and when desired by the Purchaser. All the routine and acceptance testing facilities, in house.

15.12 INSPECTION

- (i)** The Purchaser's representative shall at all times be entitled to have access to the works and all places of manufacture where conductor shall be manufactured and the representative shall have full facilities for unrestricted inspection of the Suppliers works raw materials and process of manufacture and conducting necessary tests as may be deemed fit, for certifying the quality of product.
- (ii)** The acceptance of any quantity of material shall in no way relieve the Supplier of any of his responsibilities for meeting all requirements of the specification, and shall not prevent subsequent rejection if such material is later found to be defective.
- (iii)** At least 5% of the total number of drums subject to minimum of two in any lot put up for inspection, shall be selected at random to ascertain the length of conductor by following method "At the works of the manufacturer of the conductor, the conductor shall be transferred from one drum to another at the same time measuring its length with the help of a graduated pulley & Cyclometer. The difference in the average length thus obtained and as declared by the Supplier in the packing list shall be applied to all the drums if the conductor is found short during checking."
- (iv)** The sample cut of from any numbers of drums for carrying out any type of tests will be to the suppliers account.

15.13 Packing & Forwarding:

- (i)** The conductor shall be supplied in non-returnable strong wooden drums provided with lagging of adequate strength, and displacement during transit, storage and subsequent handling and stringing operations in the field. The drums shall conform to IS:1778-1980 except otherwise specified hereinafter.
- (ii)** The drums shall be suitable for wheel mounting and for jetting off the conductor under a minimum controlled tension of the order of 5 kN.
- (iii)** The bidder should submit the proposed drum drawings & GTP along with the bid. However, the same shall be in line with the requirements as stated herein. After placement of the Letter of Award, the Supplier shall submit four copies of fully dimensioned drawing of the drum, for Purchaser's approval before taking up manufacturing of Conductor and or drums. After getting approval from the Purchaser, Supplier shall submit 6 more copies of the approved drawing to Purchaser for further distribution and field use at Purchaser's end.
- (iv)** All wooden components shall be manufactured out of seasoned soft wood free from defects that may materially weaken the

component parts of the drums. Preservative treatment for anti-termite/anti-fungus (Aldrime / Aldruse) etc. shall be applied to the entire drum with preservatives of a quality which is not harmful to the conductor nor to the persons using or storing the same.

- (v)** The flanges shall be of three ply construction with each ply at right angles to the other and nailed together. The nails shall be driven from the inside face flange, punched and then clenched on the outer face. The tolerance in thickness of each ply shall be +3 mm only. There shall be at least 3 nails per plank of ply with maximum nail spacing of 75 mm. Where a slot is cut in the flange to receive the inner end of the conductor, the entrance shall be in the line with the periphery of the barrel.
- (vi)** The wooden battens used for making the barrel of the conductor shall be of segmental type. These shall be nailed to the barrel supports with at least two nails. The battens shall be closely butted and shall provide a round barrel with smooth external surface. The edges of the battens shall be rounded or chamfered to avoid damage to the conductor.
- (vii)** Barrel studs shall be used for construction of drums. The flanges shall be holed and the barrel supports slotted to receive them. The barrel studs shall be threaded over a length on either end, sufficient to accommodate washers, spindle plates and nuts for fixing flanges at the required spacing. Barrel studs should be tack welded with the nuts after tightening.
- (viii)** Normally, the nuts on the studs shall stand proud of the flanges. All the nails used on the inner surface of the flanges and the drum barrel shall be countersunk. The ends of barrel shall generally be flushed with the top of the nuts.
- (ix)** The complete drum including inner cheek of the flanges and drum barrel surface shall be painted with bitumen based paint.
- (x)** Before reeling, card board or double corrugated or thick bituminized waterproof bamboo paper shall be secured to the drum barrel and inside of flanges or the drum by means of a suitable commercial adhesive material. The paper should be dried before use. Medium grade Kraft paper shall be used in between the layers of the conductor. After reeling the conductor, the exposed surface of the outer layer of conductor shall be wrapped with thin polythene sheet across the flanges to preserve the conductor from dirt, grit and damage during transportation and handling and also to prevent ingress of rain water during storage/transport.
- (xi)** A minimum space of 125 mm shall be provided between the inner surface of the external protective layer and outer layer of the conductor for 'Dog' conductor; however 75 mm shall be acceptable for all other conductors.
- (xii)** Each batten shall be securely nailed across grains as far as possible to the flange edges with at least 2 nails per end. The length of the nails shall not be less than twice the thickness of the battens. The nail shall not protrude above the general surface and

shall not have exposed sharp edges or allow the battens to be released due to corrosion.

- (xiii) Outside the protective layer, there shall be minimum of two binder consisting of hoop iron/galvanised steel wire. Each protective layer shall have two recess to accommodate the binders.
- (xiv) The conductor ends shall be properly sealed and secured with the help of U-nails on one side of the flanges. The end securing shall be done by taking out at least 500 mm. of steel core on either ends and sealing it with U-nails. The composite conductor shall be banded by use of galvanized steel wire/aluminium.
- (xv) Wire at three locations at the most 75 mm apart or less covered with PVC adhesive tape so as to avoid loosening of conductor layers in transit and handling.
- (xvi) If any bidder wishes to supply the conductor in the steel drums the same will be acceptable, however free of cost.

15.14 Marking

Each drum shall have the following information stenciled on it in indelible ink along with other essential data:

- a) Contract/Award letter / order number
- b) Name and address of consignee
- c) Manufacturer's name and address
- d) Drum Number
- e) Size of conductor
- f) Length of conductor in meters
- g) Gross weight of drum with conductor
- h) Weight of empty drum with lagging
- i) Arrow marking for unwinding.

15.1 Deviations:

Any deviation to this Technical Specification will be out rightly rejected. All the Bidders have to submit this specification duly authenticated without any alterations, additions etc. on each page along with the Technical Bid. Any offer without this will be out rightly rejected.

16 EARTH WIRES :

16.1 This specification provides for design, manufacture, testing, inspection, packing and dispatch, to destination of Steel Cored Earth wire, of sizes 7/3.15, specified herein for their satisfactory operation in various lines of various ratings and substations of the Mizoram State. The Earth wire shall be hot dip galvanized.

16.2 The Earth wire is to be used as Earth wire on single circuit and / or double circuit transmission lines of various ratings and / or substations of the purchaser for protection of steel structures, equipment, etc. or the substations from lightning strokes, various types of faults, etc.

16.3 The Earth wires shall conform to the following Indian / International Standards, which shall mean latest revisions, amendments / changes adopted and / or published as on the date of opening of the Tender. The list below gives only a few of the applicable Standards.

| Sr. No. | Indian Standards | Title | International Standards |
|----------------|---------------------------|--|--------------------------------|
| 1 | IS : 209 -1966 | Specification BS: 3436 for zinc | |
| 2 | IS : 2141 -1968 | Hot dipped galvanized stay | |
| 3 | IS : 1521 | Method of Ten-ISO / R 89 site testing of steel wire. | |
| 4 | IS : 2629 | Recommended practice for Hot dip galvanizing of Iron and Steel. | |
| 5 | IS : 2633 | Method of Testing uniformity of coating of Zinc coated articles. | |
| 6 | IS : 4826 | Galvanized coating on round steel wire. | ASTM A – 472 729 BS : 443 |
| 7 | IS : 6745 | Methods of determination of weight of zinc coating of zinc coated iron and steel articles. | BS : 443 |
| 8 | IS : 12776 | For Earth wire, Testing Of Earth wire | |
| 9 | IS : 398 – Part-2 1996 | Testing | |
| 10 | IS : 1778 | Wooden Drums | |

16.4 However, in an event where the supplier offers Earth wire conforming to standards other than the above, then the salient points of comparison between the standards adopted and the standards quoted herein shall be detailed in relevant schedule with an authenticated English version of such standards referred.

16.5 The Earth wire shall be suitable for being installed directly in air supported on suspension clamps (hardware) or anchored through tension clamps (hardware) at the power cross arms of single circuit, double circuit or multi circuit transmission line towers.

16.6 The Earth wire shall therefore be suitable for satisfactory operation under the tropical climatic conditions in Mizoram.

16.7 At a temperature of 20°C, the density of galvanised steel wire is to be taken as 7.80 g/cm³.

- 16.8** In order to obtain uniformity in calculations a value of 11.5×10^{-6} Per °C may be taken as the value for the co-efficient of Linear Expansion of galvanised steel wires used for the cores of steel-reinforced aluminium conductors.
- 16.9** Galvanised steel wire shall be drawn from high carbon steel rods produced by either acidic or basic open Earth process, electric furnace process or basic oxygen process. All the properties of the steel strands and wires shall confirm to the relevant standards.
- 16.10** The Zinc used for galvanising shall be electrolytic high grade Zinc not less than 99.95 percent purity. It shall conform to and satisfy all the requirements of relevant ISS, BSS or other Standards to be specified with the due justification. Galvanising has to be done by hot dip galvanising process. Neutral grease may be applied between the layers of wires, however the weight of the same shall be specified and added to the total weight of the conductor.
- 16.11** The galvanised Earth wire after stranding operation shall be dipped in boiled linseed oil before winding it on the drum.
- 16.12** The wires shall be smooth and free from all imperfections such as spills, splits, slag inclusion, die marks, scratches, fittings, blow-holes, projections, looseness, overlapping of strands, chipping of layers etc. and all such other defects which may hamper the mechanical & electrical properties of the Earth wire and also the installation of the Earth wire at the site etc. Special care should be taken to keep away dirt, grit etc. during stranding.
- 16.13** The galvanised steel wires for the stranded Earth wire covered by this standard shall have diameters specified in the clause above and shall be within the tolerances indicated therein. The diameter of the steel wires shall be measured over the zinc coating.
- 16.14** There shall be no joints except those in the base rod or wire before final drawing, in steel wires forming the Earth wire.
- 16.15** The wires used in the construction of Earth wire before and after stranding shall satisfy all the relevant requirements as per the standards indicated or any other standards with due justification.
- 16.16** The zinc used for galvanising shall be electrolytic high grade Zinc. It shall conform to and satisfy all the requirements of relevant standards indicated or any other standards with due justification. Galvanising shall be done by hot dip galvanising process. Neutral grease should be applied between the layers of wires

- 16.17** In all constructions, the successive layers shall have opposite directions of lay, the outermost layer being right-handed. The wires in each layer shall be evenly and closely stranded.
- 16.18** The standard length of the earth wire shall be 2000-meter. A tolerance of +/-5% on the standard length shall be permitted. All lengths outside this limit of tolerance shall be treated as random lengths.
- 16.19** Random lengths will be accepted provided no length is less than 95% of the standard length specified and the total quantity of such random lengths shall not be more than 5% of the total quantity ordered.
- 16.20** Bidder shall also indicate the maximum single length, above the standard length, he can manufacture in the guaranteed technical particulars. This is required for special stretches like river crossing etc. The purchaser reserves the right to place orders for the above length to the extent of 50% of the total ordered quantity on the same terms and conditions applicable for the standard and special lengths during the tendency of the contract.
- 16.21** The type, acceptance, routine tests, tests any specifically demanded by the P&E Deptt and tests during manufacture shall be carried out on the Earth wire free of cost.
- 16.22** 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 (all the coils of the galvanised steel stranded Earth wire which are of the same grade, diameter and construction and are manufactured under similar condition in a single group and / or at a time from the same lot of raw materials, shall mean the lot). These tests shall be carried out at the manufacturers works in presence of P&E Deptt's representative before the dispatch of the materials to the site.
- 16.23** Routine tests shall mean those tests, which are to be carried out on each strand/spool/length of the Earth wire, continuously, to check requirements which are likely to vary during production. These tests shall be carried out by the manufacturer on each drum and shall have to furnish the reports to the P&E Deptt's representative during his visit for acceptance tests
- 16.24** One sample from each of the lot offered for the acceptance test shall be taken and chemical analysis shall be carried out. The contents and values of the various contents shall be as specified in this specification.
- 16.25** **Routine tests**
- a) Checks ensure that the joints are as per specifications.

- b) Check that there are no cuts, fins etc. on the strands.
- c) Check that drums are as per specification.
- d) All acceptance tests as mentioned in Clause 7.3 above shall be carried out on each coil.

16.26 The testing charges for the type tests specified and as per relevant IS shall be borne by the bidder.

16.27 In case of failure in any of the type test/s, the supplier is either required to modify the design of the material or repeat the particular type test three times successfully at his own expenses.

16.28 The Purchaser's representative shall at all times be entitled to have access to the works and all places of manufacture where Earth wire shall be manufactured and the representative shall have full facilities for unrestricted inspection of the Suppliers works raw materials and process of manufacture and conducting necessary tests as may be deemed fit, for certifying the quality of product.

16.29 No material shall be dispatched from its point of manufacture before it has been satisfactorily inspected, tested, and necessary dispatch instructions are issued in writing, except for the cases where waiver of inspection is granted by competent authority of the P&E Deptt.

16.30 The acceptance of any quantity of material shall in no way relieve the Supplier of any of his responsibilities for meeting all requirements of the specification, and shall not prevent subsequent rejection if such material is later found to be defective.

16.31 The Earth wire shall be supplied in non-returnable strong wooden drums provided with lagging of adequate strength, and displacement during transit, storage and subsequent handling and stringing operations in the field. The drums shall generally conform to IS: 1778-1980 except otherwise specified hereinafter.

16.32 The drums shall be suitable for wheel mounting and for jetting off the Earth wire under a minimum controlled tension of the order of 5 kN.

16.33 Each drum shall have the following information stenciled on it in indelible ink along with other essential data:

- a) Contract/Award letter / order number
- b) Name and address of consignee
- c) Manufacturer's name and address
- d) Drum Number

- e) Size of Earth wire
- f) Length of Earth wire in meters
- g) Gross weight of drum with Earth wire
- h) Weight of empty drum with lagging
- i) Arrow marking for unwinding.

16.34 The details of wires are tabulated below:

| Sr. No | Description | Parameters |
|--------|--|---|
| 1 | Number Of Strands | 7 |
| 2 | Diameter Of Strand - mm. l) Strands a)Nominal b)Maximum c)Minimum | 3.15 3.23 3.07 9.45 |
| 3 | Cross Sectional Area Of - Sq. mm. a)Earth wire b)Each Strand | 54.55 7.793 |
| 4 | Laying Of Strands a)Center b)First Layer | 1 6 |
| 5 | Weight (Excl. Wt. Of Grease) - Kg /Km. a)Earth wire b)Strand (At Nominal Dia.) | 428.00 61.143 |
| 6 | Maximum d.c. resistance in ohm, per km of the galvanized steel earth strand at 20°C | 3.41 |
| 7 | Ultimate Tensile Strength Earth wire - KN a)Minimum tensile strength of strand (before stranding)N/mm.sq. b)Minimum tensile strength of strand (after stranding)N/mm.sq. | 56 1100 1050 |
| 8 | Modulus of Elasticity - Kg / Sq. mm. | 1.9 X 10 ⁴ |
| 9 | Coefficient of linear expansion - per deg.C. | 11.5 × 10 ⁻⁶ |
| 10 | Chemical Composition - % a)Carbon b)Manganese c)Phosphorous d)Sulphur e)Silicon | 0.55 Max. 0.40 - 1.10x 0.05 Max. 0.05 Max. 0.15 - 0.35 |
| 11 | Zinc Purity - % | 99.95 |

17 SURVEY

Walk over survey, Theodolite survey, profile survey (if required) shall have to be carried out to establish the route alignment by the contractor for new 33 kV lines. If the line is passing by any City/Town/Village areas, permission from local bodies, NH authority and State high way authority has to be obtained prior to execution of work.

17.1 Check Survey :

The contractor shall undertake the check survey during execution on the basis of the alignment profile drawing and tower schedule approved by the concerned authority. During check survey, minor changes due to Right of way or any other unavoidable constraints, the contractor may have to change the said alignment after obtaining prior approval from the authority.

17.2 General:

Preliminary route alignment in respect of the proposed 33KV transmission lines has been fixed by P&E Deptt subject to alteration of places due to way leave or other unavoidable constraints. The Right of way shall be solved by the contractor and all expenses there of shall be borne by him. However, P&E Deptt shall render all helps in co-ordination with law and order department for solving the same. Involvement of forest land should be restricted as far as possible.

17.3 Provisional quantities/numbers of different types of tower structures, Length cables, Conductors etc have been estimated and indicated in the BOQ Schedule given. However final quantities for work shall be as determined by the successful bidder, on completion of the detail survey, preparation of route profile drawing and designing of the different items as elaborated in the specification and scope of work.

17.4 The contractor shall undertake detailed survey on the basis of the tentative alignment fixed by P&E Deptt. The said preliminary alignment may, however, change in the interest of economy to avoid forest and hazards in work. While surveying the alternative route the following points shall be taken care of by the contractor.

- (i)** The line is as near as possible to the available roads in the area and the route is straight and short as far as possible.
- (ii)** Good farming areas, religious places, forest, civil and defense installations, aerodromes, public and private premises, ponds, tanks, lakes, gardens, and plantations are avoided as far as practicable.
- (iii)** The line should be far away from telecommunication lines as reasonably possible. Parallelism with these lines shall be avoided as far as practicable.
- (iv)** Crossing with permanent objects are minimum but where unavoidable preferably at right angles.

- (v) Difficult and unsafe approaches are avoided.
- (vi) The survey shall be conducted along the approved alignment only.
- (vii) For river crossing/ Crossing of drains : Taking levels at 25 meter interval on bank of river and at 50 meter interval at bed of river so far as to show the true profile of the ground and river bed railway/road bridge, road The levels shall be taken at least 100 m. on either side of the crossing alignment. Both longitudinal and cross sectional shall be drawn preferably to a scale of 1:2000 at horizontal and 1:200 vertical.
- (viii) After completing the detailed survey, the contractor shall submit the final profile and tower schedule (with no. of tower) for final approval of P&E Deptt. To facilitate checking of the alignment, suitable reference marks shall be provided. For this purpose, concrete pillars of suitable sizes shall be planted at all angle locations and suitable wooden/iron pegs shall be driven firmly at the intermediate points. The contractor shall quote his rate covering these involved jobs.

18 PROFILE PLOTTING AND TOWER SPOTTING:

With the help of sag template, final tower location shall be marked on the profiles and while locating the tower on survey chart, the following shall be kept in mind:

18.1 SPAN

- The span should be as near as possible to the basic design span so that the minimum ground clearance should not less than 7.0 mts in cross country at maximum sag condition.
- In urban areas minimum in every Half KM one angle tower (Cut point) has to be provided.
- In other areas in every 1.5 KM one angle tower (Cut point) may be provided.

18.2 WAY-LEAVE AND TREE CUTTING

- Way-leave permission which may be required by the contractor shall be arranged at his cost. While submitting final-survey report for approval, proposals for way-leave right of way shall be submitted by the contractor. CESU may extend help to get the permission within a reasonable time as mutually agreed upon for which due notice shall be given by the contractor in such a way so that obtaining permission from appropriate authority do not hinder the continued and smooth progress of the work.

- CESU shall not be held responsible for any claim on account of damage done by the contractor or his personnel to trees, crops and other properties.
- The contractor shall take necessary precaution to avoid damage to any ripe and partially grown crops and in the case of unavoidable damage, the CESU shall be informed and necessary compensation shall be paid by the contractor.
- All the documents required for application to the statutory authorities must be prepared by the contractor & submitted to the CESU for submission of the application towards approval of NH authority, State authority etc. However, the responsibilities lie with the contractor to get the clearance.
- Trimming of tree branches or cutting of a few trees en-route during survey is within the scope of survey to be done by the contractor. Contractor shall arrange for necessary way-leave and compensation in this regard. During erection of the line, compensation for tree cutting, damage caused to crops, actual cutting and falling of the tree including way-leave permission for such route clearance shall be arranged by the contractor at his cost. The contractor will identify the number of trees and detail of obstructions to be removed for erection of the line and intimate P&E Deptt well in advance in case of any help. Other related works like construction of temporary approach roads, etc. as required, shall be done by the contractor and the same will lie within the scope of contractors work and such cost shall be considered to be included in the rates quoted by him.

19 EARTH WORK FOR TOWER FOUNDATION

The Foundation is to be designed to withstand the loads of the Superstructure for the full footing actions obtained from the structure stress analysis in conformity with the relevant factors of safety. The reactions on the footings shall be composed of the following types of loads for which they shall be required to be checked.

- i) Maximum Tension or Uplift
- ii) Maximum Compression or Down Thrust
- iii) Maximum Horizontal Shear or Side Thrust

The additional weight of Concrete in the footing below ground level over the earth weight and the full weight of Concrete above the ground level in the footing and the Steel Parts will also be taken into account adding to embedded the down thrust. To neutralise uplift effect, level ground should be

maintained around Foundation Pits to the extent as indicated by the angle of repose. Where sufficient level ground is not maintained, the Contractor shall make retaining/toe walls as required.

19.1 General Requirements:

The contractor shall provide all tools, plants, instruments, qualified supervisory personnel, labour materials, any temporary workers, consumables, and everything necessary, whether or not such items are specifically stated herein, for completion of the project in accordance with specification requirement. The excavation shall be done in accordance with the design and drawing. This shall also includes, where ever required, proper shoring shuttering to maintain excavations and also the furnishing, erecting and maintaining of substantial barricades around excavated areas and warning lamps at night for ensuring safety of lives and property.

Scope also includes dumping of excavated materials in regular heaps, bunds, rip rap with regular slope as directed by Engineer-in-charge within the lead specified and leveling the same so as to provide natural drainage. Rock/soil excavated shall be stacked properly. All softer materials shall be laid along the center of the herpes, the harder and more weather resisting materials forming the casing on the sides and the top. Rocks shall be stacked separately.

The area to be excavated /filled shall be cleared of trees, plants, stumps, bush, vegetation rubbish etc. and other objectionable matter. If any roots or stumps or trees are met during excavation, they shall be removed as directed by Engineer-in-charge.

19.2 Soft/Loose Soil:

These shall include all kinds of soils containing pellets, Sand, Silt and are removable by ordinary pick axes, shovel and spade and which is not classified under “Dense/Compact” “soft dis-integrated” and “Hard Rock” category as defined below:

19.3 Dense/Compact Soil:

Spoil removable by pick-axe, crowbar etc. Moorum or shingle, gravel, clay, loam peat etc.

19.4 Soft & Decomposed / Dis-integrated Rock:

This shall include rock, boulders, shale, chalk, slate, hard mica, schist, laetrile and all other materials which in the opinion of the Engineer-in- charge is rock, does not need blasting and could be removed with picks, hammer, crow bars, wedges and pneumatic breaking work. This shall also include rock boulders not longer than one meter in any direction and not more than 500 mm in any one of the other two directions.

19.5 Hard Rock :

This shall include all rock occurring in continuous masses which cannot be removed except by blasting for loosening it. Harder varieties of rock with or without veins and secondary minerals, which in the opinion of

the Engineer-in-charge require blasting, shall be considered as hard work.

19.6 Sub-merged Soil :

Where the subsoil water table is encountered within the range of foundation depth, the soil below the water table and that at locations where pumping or bailing out of water is required due to presence of surface water will be treated as wet soil. Soil partially submerged and fully submerged shall also come under this category. In case of pile foundations submerged soil; the required sand filling should be done by the contractor by his own cost.

Where soil at a tower foundation is of composite nature, classification will be according to the type of soil, which is preponderant in the footing and the rate for the same will apply for the composite foundation. The decision of the P&E Deptt Engineer-incharge shall be final and binding with reference to classification of soils.

- All surplus excavated soil along with left over gradients if any “should be removed from work site and dumped at any suitable place in such a manner that the landowner will not object. A thin layer of nearly 200mm of surplus earthy can be stacked over the excavated pits for future compaction.
- Standard penetration test to be carried out for long line one in ten support sites. Back filling has to be done by borrowed earth if required.
- All organic or other foreign materials shall be removed from back fill earth. The earth shall be deposited in maximum 200mm. Layers, leveled and watered and rammed properly before another layer is deposited.
- The back filling should be such that enough moisture would be available for curing of the concrete embedded. Sufficient water shall be poured over the back filled earth for proper consolidation. All surplus excavated soil shall be stacked around the tower legs. In case of wet locations, de-watering, shoring and shuttering etc. if required shall be paid for based on unit rates indicated. The actual quantity shall be as approved by the Engineer-in charge. The shoring and shuttering is to be done by very good quality planks and supports as approved by Engineer-in-charge.

20 STUB-TEMPLATE SETTING, CONCRETING OF STUBS AND COPPING :

The stub shall be set correctly in accordance with approved method at the exact location and alignment with the help of stub setting templates as per the standards. The levels and alignment shall be checked and approved by Engineer-in-charge for which adequate advance intimation shall be given by the contractor. The approval shall not, however, relieve the contractor of his responsibility of correctness of setting.

The bottom of the pits shall be free from loose earth and shall have about 150mm. Thick layer of sand or a lean concrete [1:4:8] mat, before stubs are

set for concreting. The concrete shall be as specified in relevant I.S.S. for such work or as directed by the Engineer-in-charge. It shall be 1:2:4 mix with proper quality of sand, cement and granite chips as stated below: The concreting of stubs shall not be made in parts and it should be a continuous process till completion.

Reinforcement, as per approved drawings. In no case the bottom most portion clits of stub should be more or less than 75mm from the bottom finished level.

21 CONCRETING:

(i) Sand :

The sand to be used for concreting shall be coarse and from available Local River beds free from clay and other undesirable organic & inorganic materials like dust, lump, loam, mica, saline and other deleterious substances.

(ii) Coarse Aggregate:

The coarse aggregate to be used shall be of broken granite rock varying in size from 20mm. to 40mm. to be approved by the Engineer-in-charge provided the resultant concrete shall meet the requirement of IS:456-1964 M150 quality.

(iii) Water:

Clear non-saline, free from oils, acids alkalis and organic materials water from river, tank or well shall be used in concreting.

(iv) Concreting

The stock position/condition of cement will be subject to inspection by the Engineer-in charge at any time and at the time of use in the work.

For reconciliation of cement account, consumption of cement shall be considered as under:

| | | |
|---------|--------|-----------|
| 1:1.5:3 | Mix | - |
| 1:2:4 | Mix | 330kg/cum |
| 1:3:6 | Mix | 225kg/cum |
| 1:5 | Cement | 87kg/cum |
| 1:4:8 | Mix | 115kg/cum |

Before laying the concrete the stub shall be cleaned of rust, scale, mud etc with a steel wire brush. The method of placement of concrete shall be such as not to result in loss of workability or in segregation of concrete mix.

In wet locations, the site must be kept completely dewatered, both during the placing of the concrete and for 24 hours thereafter to protect the concrete from water during this period.

The Concrete Foundation for the Transmission Line Tower shall consists of two portions namely –

i) Pyramid ii) Chimney

- 1) In Chimney portion, the thickness of the Concrete cover should be such that it provides minimum cover of required dimensions from any part of the Stub Angle to the nearest outer surface of the Concrete in respect of all dry locations, and the minimum section of Chimney should be arrived at a safe value for dry locations as well as wet locations.
- 2) The Chimney top or muffing must be shown clearly above ground level in dry locations.
- 3) The size of the bottom portion of the Pyramid Foundation should be according to nature of the sub-soil met with at the designed depth for the Stub Angles.
- 4) The minimum base thickness in the Pyramid portion in case of submerged Foundation may be taken as 200mm.

22 ERECTION :

Erection of transmission line shall include all necessary works before commissioning of the line including but not limited to the following:

- (i) Submission of erection program with bar chart.
- (ii) Detailed survey Including location marking.
- (iii) Submission of Soil Testing/investigation Report.
- (iv) Submission of Tower foundation design as per the Soil Test Report for Approval.
- (v) Stub template setting, concreting of stubs, curing and coping. > Earthing of tower.
- (vi) Erection of super structure and accessories.
- (vii) Fixing of Insulator and accessories, paving out and stringing of conductors with all accessories, fittings, dampers etc. complete for power conductors.
- (viii) Paving out and stringing of earth wire with all accessories, fittings of dampers etc. complete for earth wire.
- (ix) Checking and commissioning of the line after completion of all erection works.
- (x) Getting clearance from Chief Electrical Inspector (P&E Deptt) Govt. of Mizoram.
- (xi) Solving all type of ROW problem and payment of compensation at his own cost to make the location free for construction erection and stringing work.
- (xii) Payment of all type of crop compensation at his own cost.
- (xiii) The contractor shall arrange the security for watch and ward for the entire work including the work already done till handing over of the line at his own cost. Engaging own security at own cost till final handing over of the line to P&E Deptt.
- (xiv) Any incidental work not covered in the specification but are required for completion of the line and commissioning thereof.
- (xv) All other materials required for satisfactory construction of Transmission lines such as sand, coarse aggregate, all type of fine aggregates, jelly, explosives, earth pit filling, materials like charcoal

and salt etc, form boxes, shutters. Erection tools and works etc. of approved quality shall be inclusive of the cost of such materials and all other expenses incidental to execution of this contract shall be borne by the contractor.

22.1 ERECTION OF SUPER STRUCTURE WITH ACCESSORIES

The super structure shall be erected as per approved structural drawings to be furnished by the Contractor. All members shall be carefully handled during transport and erection so that the galvanizing is not scratched and the interior steel not exposed. In storage and at tower site all tower steels shall be kept clear of the ground in a clean and dry condition. Contact with brackish water or other substances likely to attack galvanizing shall be avoided. All superficial rust stains, corrosive salts and other corrosive foreign materials deposited prior to or during installation of the tower shall be removed without causing damage to the protective surfaces. Towers shall be erected in a workman like manner and tower members shall not be strained or deformed during course of erection.

The method followed for the erection of towers shall ensure the points mentioned below:-

- (i)** Straining of the members shall not be permitted for bringing them into position. It may, however, be necessary to match hole positions at joints and to facilitate this, Tommy bars not more than 450 mm. long may be used.
- (ii)** Before starting erection of an upper section, the lower section shall be completely braced and all bolts provided in accordance with approved drawings.
- (iii)** All plan diagonals relevant to section of tower shall be placed in position before assembly of upper section is taken up.
- (iv)** All bolts will have their bolt heads facing outside/inside of the tower as convenient, for horizontal or nearly horizontal bolt connection and upwards for vertical bolt connections.
- (v)** Slings and other works used for picking up members, portions of towers or complete towers, shall be protected in such a manner as to prevent cuttings into the corners of members, damaged the finish or portions of towers shall be raised in such a manner that no dragging on the ground surface or against portions of the towers already erected will occur.
- (vi)** Normally three version towers will be used viz: "B", "C" and "S" type with their extensions.
- (vii)** The method of erection is left to the contractor subject to his responsibility for any damage done to the materials due to any cause. The erection of towers should not be started earlier than 15 days after back fill of the stubs so that there is no disturbance or damage to the concrete and also to allow it to acquire its full strength. Approval of the Engineer-in-charge to start erection work shall be obtained. After the final tightening of bolts and nuts the treads shall be punched so

as to prevent loosening under temperature changes or vibrations. The towers must be truly vertical after erection and no straining will be permitted to bring them so. Towers shall be so erected that the vertical axis through the center of the gravity shall not be out of plumb by more than one centimeter for every 500 centimeter of height.

22.2 TIGHTENING AND PUNCHING OF BOLTS AND NUTS

All nuts shall be tightened properly using correct size spanners or torque wrenches. Before tightening, it shall be seen that filler washers and plates are placed in relevant gaps between members bolts of proper size and length are inserted under each nut and in case of steps bolts, spring washers have been placed under the outer nut. The tightening shall progressively be carried out from the top down wards and checked back from bottom upwards before punching care being taken that all bolts at every level are tightened simultaneously. The minimum 3 thread should be projected after final tightening. After final tightening, the projected thread should be riveted by using hammer. In the complete tower, the nuts for bolts shall be tightened to the following torque.

Size of bolts tightening torque

| | |
|-----------|----------------|
| 12 mm dia | 600-800 kg-m |
| 16 mm dia | 1000-1200 kg-m |
| 20 mm dia | 1400-1800 kg-m |
| 24 mm dia | 2000-2500 kg-m |

22.3 FIXATION OF INSULATORS AND HARDWARES

Insulators shall be handled carefully in all stages of handling and be individually checked for cracks, damage, and loss of glaze etc. before assembly and erection at site, which shall be according to the drawings approved by P&E Deptt. The rigging and hoisting of insulator strings shall be done very carefully so that no damage is caused to the insulators and hard wares. At all major high ways, Main River and utility line crossing double string of insulators shall be used.

The entire stringing work of conductor and earth wire shall be carried out by tension stringing technique. The contractor shall indicate in their offer, the sets of tension stringing equipment he is having in his possession and the sets of the stringing equipment he would deploy exclusively for this package which under no circumstance shall be less than the number and capacity requirement indicated in Qualifying Requirements for Bidder.

22.3.1 Materials:

The Bidder should have assured access to supply Earth wire, hardware

fittings and Conductor & Earth wire accessories from qualified manufacturers. Type test certificate from testing laboratory should be attached with the offer.

- Earth wire: Galvanized steel ground wire of size 7/3.15 mm or above from any reputed manufacturer.
- Hardware Fittings: 90KN/75KN Hardware fittings of reputed manufacturer.
- Insulator String Hardware
- Arcing horns
- Free center type/ Amour grip suspension clamp for suspension strings.
- Compression type dead end clamp.
- Sag adjuster.
- Balancing weight
- Accessories for Conductor & Earth wire (As may be applicable)
 - ✓ Mid Span compression joint
 - ✓ Repair Sleeves
 - ✓ Flexible copper bonds
 - ✓ Bundle spacers
 - ✓ Vibration dampers
 - ✓ Rigid Spacer
 - ✓ Suspension clamp for earth wire.
 - ✓ Tension clamp for earth wire

22.3.2 Service Conditions:

Equipment/ material to be supplied against this specification shall be suitable for satisfactory continuous operation under tropical conditions as specified below:

- (i) Maximum ambient temperature (Degree Celsius) : 50
- (ii) Minimum ambient temperature (Degree Celsius) : 0
- (iii) Relative humidity (% range) : 10 100
- (iv) Wind zone (as per IS : 875) :49 m/sec
- (v) Maximum altitude above mean sea level (Meter) : Up to 1000m
- (vi) Isoceraunic level (days/years) : 50
- (vii) Moderately hot and humid tropical climate conducive to rust and fungus growth. Climate varies from moderately hot and humid tropical climate to cold climate.

22.3.3 General Climatic Conditions:

Climatic conditions shall be of tropical nature having summer period for 8 months and winter period for 4 months in a year. The maximum temperature during summer be of the order of 40 Deg. C and the

minimum temperature in the winter shall be of the order 10° C. Normal every day temperature is 28°C.

22.3.4 Working Seasons:

Working season shall be approximately 9 months/year and balance 3 months shall be monsoon period. For this particular work two working seasons shall be allowed to the contractor.

22.3.5 Access to the Line and Right of Way:

Right of way and way leave clearance shall be arranged by the Contractor in accordance with work schedules. Owner will secure way leave and Right of way in the Forest area but the contractor shall maintain the same for the entire period of the contract.

22.3.6 Clearance from Ground, Building, Trees etc

Clearance from ground, buildings, trees and telephone lines shall be provided in conformity with the Indian Electricity Rules, 1956 as amended up to date. The tree cutting shall be the responsibility of the Owner except for that required during survey. However, the Contractor shall count, mark and put proper numbers with suitable quality of paint at his own cost on all the trees that are to be cut by the Owner at the time of actual execution of the work as detailed below. Contractor may please note that Owner shall not pay any compensation for any loss or damage to the properties or for tree cutting due to Contractor's work

22.4 EARTHING

Every tower shall be suitably earthed so that the tower footing resistance does not exceed 10 Ohms. Depending on the earth resistivity of soil it is to be decided by the Engineer-in charge whether pipe type Earthing or counterpoise Earthing is to be provided, details of which shall be indicated in the approved drawings. The earth electrode shall be 40mm. dia 3 mtr. Long heavy duty GI pipe. The contractor shall supply bentonite powder for each earth pit. The contractor is required to take soil resistivity reading at each location before start of work.

23 STRINGING OF OVERHEAD CONDUCTOR & GROUND WIRE

- **General**

The overhead ground wire(s) shall be strung for the entire length of the transmission line, and shall be attached to the towers in accordance with the details same as for conductor(s). The work,

methods, and limitations used for installing the overhead ground wire shall be the same as for installing the conductor.

- **Stringing of overhead ground wire**

The overhead ground wire shall be strung in advance of the conductors, and the method shall be the same as for conductor string. The same degree of care shall be exercised to avoid damage or injury of the overhead ground wire. If damaged, the contractor in a manner approved by the Engineer-in-charge shall replace them.

- **Jointing of conductor & ground wire**

Compression type joints and clamps shall be installed in accordance with the printed instructions of the manufactures. Galvanized tension sleeves shall, after jointing, be coated effectively with an approved rust preventive paint and shall further be furnished with a repair coat of paint after final passage through snatch blocks.

- **Sagging**

After being sagged, the Conductor & overhead ground wire shall be clipped in the same manner. Suspension clamps of overhead ground wire shall be installed in such a manner that earthling bond wires shall all face a given direction. The ends of bond wires shall be clamped with terminal clamps in an approved manner. In no case the sagging of the ground wire will be more than the conductor sag. The mid-span clearance between ground wire and power conductor should be more than the clearance near the tower in order to avoid flashover during lightening surge.

- **Fixing of conductor and ground wire accessories** Vibration dampers and other conductor and ground wire accessories shall be installed by the contractor as per the design requirement and as per the respective manufactures instruction. Dampers shall be fastened securely, so that all dampers will hang in vertical planes. Vibration dampers shall be installed within 24 hours after the conductor has been clipped in.

- **Fixing of tower accessories**

All towers accessories such as anti climbing devices phase plate, number plate, danger plate etc. shall be fixed in an approved manner. The bird guard should be fixed in all X arms of tangent tower at the time of erection of tower.

- **Special works**

Special works which are not within the scope of this contract but come up during the execution of the works shall be carried out by the contractor at mutually agreed

methods and rates to be decided before the commencement of such works. All nuts up to the bottom cross arm shall be welded continuously to the bolt by the contractor using his own welding rod and skilled welder as per schedule of quantity.

24 FACTOR OF SAFETY :

The following factors of safety are adopted during design of the foundations.

- a) Against Overturning due to Uplift
 - i) Under Broken Wire Condition - 1.5
- b) Against Subsidence due to Compression produced by Working Loads on Tower Legs.
 - i) Under Normal Conditions - 2.0
 - ii) Under Broken Wire Condition - 1.5

25 DEPTH OF FOUNDATION :

The total depth of Foundation below the ground level shall not be less than 1.5 metre. To maintain interchangeability of Stubs of each type of Towers almost the same depths of foundation shall be used. However, the maximum depth of Foundations for all types of Towers shall not be more than 3 metre below the ground level.

26 RIGHT OF WAY :

In case of Right of Way, the amount of compensation required, if any, will be assessed by the authority of Government of Mizoram and solved by the Owner.

27 SUPPLY OF CONSTRUCTION MATERIALS :

No construction materials will be provided by the P&E Deptt.

28 METHOD OF ERECTION OF TOWERS :

The method will be left to the Contractor subject to the responsibility for any damage done to the materials due to any cause.

- (i) The Towers shall be exactly Vertical after the erection and no straining will be permitted to bring them to a Vertical position. Tolerance limit for Vertical shall be one in 360 of the lower height.
- (ii) The single lower cross arm should be fixed so as to give maximum ground clearance and to suit the topographic conditions of the ground.
- (iii) All Nuts shall be tightened properly. Before tightening the nuts it has to be ensured that Filler Washers and Plates are placed in relevant gaps between members; bolts of proper size and length are inserted and one Spring Washer is inserted under each Nut. The tightening shall

progressively be carried on from the top to downwards. Care shall be taken that all Bolts at every level are tightened simultaneously.

- (iv) The Threads of Bolts projecting outside Nuts shall be punched at three positions on the diameter to ensure that the Nuts are not loosened in course of time. If during tightening a Nuts is found to be slipping or running over the Bolt Threads, the Bolt together with the Nuts shall be changed immediately.
- (v) The Contractor shall arrange for Tack Welding of all Nuts and Bolts upto the Bottom Cross Arm level of the Towers, if so desired by the Purchaser. The Quoted Rates for erection of Towers are, therefore, exclusive of the cost of above Tack Welding.

29 FINAL CHECKING, TESTING AND COMMISSIONING :

After completion of the works, final checking of the Lines shall be done by the Contractor to ensure that all the Foundation Work, Tower Erection and Stringing have been done strictly according to the specifications and as approved by the Owner. All the works shall be thoroughly inspected keeping in view the following main points :-

- i) Sufficient Back Filled Earth is laid over each Foundation Pit and it is adequately compacted. Sufficient level ground is maintained at the base of Towers as dictated by angle of response.
- ii) Concrete chimneys and their copings are in good and final shaped condition.
- iii) All the Tower members are correctly used strictly according to final approved Drawings and are free of any damage or defect whatsoever.
- iv) All the Bolts are fully tightened and they are properly punched. The Contractor shall submit a report to the above effect. After the final checking the Line shall be tested. Insulation and any defects found out as a result of such test shall be rectified by the Contractor.

All arrangements for such test shall be made by the Contractor and necessary labour, transport and equipment shall be provided by the Contractor.

After satisfactory test on the Line and on approval by the Owner, the Line shall be energized at Full Operating Voltage before handing over.

Technical and Other Particulars for 33kV Line

| | | |
|----------|-----------------------------|-----------------------------|
| A | System Particulars : | |
| a) | System | AC 3-Phase |
| b) | Line Voltage | 33kV |
| c) | Frequency | 50Hz |
| d) | Number of Circuits | Single Circuit on D/C tower |
| e) | Neutral Grounding System | Effectively Earthed. |

| | |
|--|----------------------------|
| B Conductors : System Voltage a) Material b) Code Name | 33kV ACSR Dog |
|--|----------------------------|

SECTION -IV

**GUARANTEED TECHNICAL
PARTICULARS**

1. POLYMER DISC INSULATOR

| Sl No. | Description | Bidder's Particulars |
|---------------|--|-----------------------------|
| 1 | Type of insulator | |
| 2 | Reference Standard | |
| 3 | Material of FRP Rod | |
| 4 | Material of sheds | |
| 5 | Type of metal end fittings | |
| 6 | Material of end fittings | |
| 7 | Material of sealing compound | |
| 8 | Colour of sheds | |
| 9 | Rated voltage | |
| 10 | Highest voltage | |
| 11 | Dry Power Frequency Withstand voltage | |
| 12 | Wet Power Frequency Withstand voltage | |
| 13 | Dry PF Flashover Voltage | |
| 14 | Wet PF Flashover Voltage | |
| 15 | Dry Lightning Impulse withstand voltage | |
| a | Positive | |
| b | Negative | |
| 18 | Dry Lightning Impulse Flashover voltage | |
| a | Positive | |
| b | Negative | |
| 21 | RIV at 1 MHz when energised at 10 KV / 30 KV (rms) under dry condition | |
| 22 | Creepage distance (min) | |
| 23 | Visible Discharge Voltage (PF) | |
| 24 | Minimum Failing load | |
| 25 | Dia of FRP Rod | |
| 26 | Length of FRP Rod | |
| 27 | Dia of weather sheds | |
| 28 | Thickness of housing | |
| 29 | Dry arc distance | |
| 30 | Method of fixing sheds to housing | |
| 31 | No of weather sheds | |
| 32 | Type of sheds | |
| 33 | Dia of bottom end fitting | |
| 34 | Centre to centre distance between Tongue & Clevis | |

| | | |
|----|-------------------------------|--|
| 35 | Weight of composite insulator | |
| 36 | Type of packing | |
| 37 | No of insulator in each pack | |
| 38 | Weight of Insulator | |
| 39 | Gross weight of package | |
| 40 | Marking | |
| 41 | Gurantee | |

2. DOG CONDUCTOR

| Sl No. | Description | Bidder's Particulars | |
|-----------|--|----------------------|-------|
| | | Aluminium | Steel |
| 1 | Number Of Strands – Nos. | | |
| 2 | Diameter Of Strand – mm. | | |
| | i) Strands | | |
| | a)Nominal | | |
| | b)Maximum | | |
| | c)Minimum | | |
| | ii) Overall Of Conductor | | |
| 3 | Cross Sectional Area Of – Sq. mm. | | |
| | a)Whole Conductor (Appro.) | | |
| | b)Each Strand | | |
| 4 | Laying Of Strands – Nos. | | |
| | a) Center | | |
| | b) First Layer | | |
| 5 | Weight (Excl. Wt. Of Grease) – Kg / Km. | | |
| | a)Whole Conductor | | |
| | b)Strand (At Nominal Dia.) | | |
| 6 | Calculated D.C. resistance at 20 deg C (Ohms/Km) | | |
| | a)Whole Conductor | | |
| | b)Strand | | |
| 7 | Ultimate Tensile Stress – KN | | |
| 8 | Modulus of Elasticity (Kg/Sq. Cm.) | | |
| 9 | Coefficient of linear expansion (per deg. C.) | | |
| 10 | Chemical Composition (%) | | |
| | a)EC Grade Al. | | |
| | b)Copper | | |
| | c)Carbon | | |
| | d)Manganese | | |
| | e)Phosphorous | | |
| | f)Sulphur | | |
| g)Silicon | | | |
| 11 | Zinc Purity - % | | |

| | | | |
|----|---|--|--|
| 12 | Resistivity – Ohms Sq. mm / Mtr. | | |
| 13 | Density (At 20°C) – Gm / CuCm. | | |
| 14 | Constant Mass Temp. Co- efficient of resistance – Per°C | | |
| 15 | Lay Ratios | | |
| | i) Maximum | | |
| | ii)Minimum | | |
| 16 | Elongation (Minimum) - % Before stranding | | |

3. EARTH WIRE

| Sl No. | Description | Bidder's Particulars |
|--------|--|----------------------|
| 1) | Number Of Strands – Nos. | |
| 2) | Diameter Of Strand – mm. I) Strands a)Nominal b)Maximum c)Minimum II) Overall Of Earthwire | |
| 3) | Cross Sectional Area Of – Sq. mm. a)Total b)Each Strand | |
| 4) | Laying Of Strands – Nos. c) Center b) First Layer | |
| 5) | Weight (Excl. Wt. Of Grease) – Kg / Km. a)Whole Earthwire b)Stand (At Nominal Dia.) | |
| 6) | Ultimate Tensile Strength Earth wire - KN a)Minimum tensile strength of strand (before stranding)N/mm.sq. b)Minimum tensile strength of strand (after stranding)N/mm.sq. | |
| 7) | Modulus of Elasticity – Kg / Sq. Cm. | |
| 8) | Coefficient of linear expansion - per deg. C. | |
| 9) | Chemical Composition - % a) Carbon | |

| | | |
|-----|--|--|
| | b) Manganese c) Phosphorous d) Sulphur e) Silicon | |
| 10) | Zinc a) Purity - % i)Zinc Min. ii)Lead Max. iii)Cadmium Max. iv)Iron Max. v)Total Impurities b) Quality | |
| 11) | Length Of Lays a) First Layer i) Maximum ii)Minimum | |
| 12) | Joint | |
| 13) | Standard Length – Mtrs. | |
| 14) | Oil Treatment | |
| 15) | Weight Of Zinc Coating – Gm / Sq. Mtr. a)Before Stranding b)After Stranding | |
| 16) | Galvanising Process | |
| 17) | Elongation (Minimum After Stranding) - % | |
| 18) | Maximum d.c. resistance in ohm, per km of the galvanized steel earth strand at 20°C | |
| 19) | Drawings Of Drum (With All Details) | |
| 20) | Details of Manufacturers of Steel Wire Rods | |
| 21) | Standard Drum Length – Mtr. a)Normal b)Special River Crossing Etc | |

Signature with Seal of the Bidder

PRICE SCHEDULE

| Sl. No | Description of Items | Unit | Provisional Qty | Rate | Amount |
|-------------------------|---|-------------|------------------------|-------------|---------------|
| Preliminary Work | | | | | |
| 1 | Investigation, reconnaissance survey, etc. | km | 6 | | |
| 2 | Detailed survey including route alignment, profiling, tower spotting and check survey | Km | 6 | | |
| 3 | Compensation of Crops, trees, Right of ways etc | Km | 6 | | |
| Sub-Total 'A' | | | | | |
| Supply | | | | | |
| 1 | Lattice-type towers with stubs & template (fabricated, galvanised steel) with stubs {Details in Appendix-I} | MT | 61.02 | | |
| 2 | Galvanised nuts & bolts, assorted sizes {Details in Appendix-I} | MT | 2.82 | | |
| 3 | Danger plates | Nos | 48 | | |
| 4 | Number plates | Nos | 48 | | |
| 5 | Phase plate | Set | 144 | | |
| 6 | Anti-climbing device | Set | 24 | | |
| 7 | Earthing Set | Loc | 24 | | |
| 8 | Midspan compression joints for Dog Conductor | Nos | 28 | | |
| 9 | Vibration dampers for dog conductor | Nos | 160 | | |
| 10 | Tension clamps with terminal for jumpers for Dog conductor | Nos | 160 | | |
| 11 | P.G.Clamp (3-bolted) for Dog Conductor | Nos | 160 | | |
| 12 | Midspan compression joints for ground wire | Nos | 24 | | |

| | | | | | |
|------------------|---|----------------|--------|--|---|
| 13 | Repair sleeves for ground wire | Nos | 24 | | |
| 14 | Vibration Damper (stock-bridge type) for tension locations for ground wire | Nos | 68 | | |
| 15 | P.G. Clamp (3 bolted) for earthwire | Nos | 68 | | |
| 16 | Copper Earthbond | Nos | 36 | | |
| 17 | 33kV Polymer Insulator 70KN | No | 260 | | |
| 18 | 33Kv Single tension Assembly 3-bolted type Complete for Dog Conductor | No | 260 | | |
| 19 | Conductor, ACSR DOG (allowing 3% for sag and wastage) | KM | 19 | | |
| 20 | Ground wire (allowing 3% for sag and wastage) | KM | 6.5 | | |
| TOTAL 'B' | | | | | - |
| Erection | | | | | |
| 1 | Earthwork in Benching to get Foundation width, level and side shapes etc and dressing to level | | | | |
| | a) Normal Soil | m ³ | 628.53 | | |
| | b) Hard Soil | m ³ | 209.51 | | |
| | c) Soft Rock | m ³ | 628.53 | | |
| | d) Hard Rock | m ³ | 628.53 | | |
| 2 | Excavation & Back Filling of pit: | | | | |
| | Earthwork in excavation in foundation pits including refilling the pits after ,pits ramming, watering etc and others upto the full satisfaction of the site Engineer. | | | | |
| | a) Normal Soil | m ³ | 354.81 | | |
| | b) Hard Soil | m ³ | 118.27 | | |
| | c) Soft Rock | m ³ | 354.81 | | |
| | d) Hard Rock | m ³ | 354.81 | | |
| 3 | Design,supply,transportation to site and erection of couterpoise type earthing. | | | | |
| | (i) 0-15 Running Metre | Nos | 48 | | |

| | | | | | |
|----------|---|-------|--------|--|--|
| | (ii) Pipe type earthing | Nos | 48 | | |
| 4 | Setting of stub (sets of four) including transportation and distribution of stubs and accessories etc.. | | | | |
| | B+0 | Loc. | 7 | | |
| | B+3 | Loc. | 4 | | |
| | B+6 | Loc. | 3 | | |
| | C+0 | Loc. | 3 | | |
| | C+3 | Loc. | 2 | | |
| | C+6 | Loc. | 2 | | |
| | S+0 | Loc. | 1 | | |
| | S+3 | Loc. | 1 | | |
| | S+6 | Loc. | 1 | | |
| 5 | PCC work in foundations in proportion 1:2:4 with maximum size of aggregate 20mm including labour, materials reinforcement, equipment, shuttering complete for handling transportation batching, mixing, placing, levelling, curing etc. as directed | Cu.M. | 208.81 | | |
| 6 | Superstructure erection including transportation and distribution of structures and accessories etc.. With fixation of anti-climbing devices paintings etc.. | | | | |
| | B+0 | Loc. | 7 | | |
| | B+3 | Loc. | 4 | | |
| | B+6 | Loc. | 3 | | |
| | C+0 | Loc. | 3 | | |
| | C+3 | Loc. | 2 | | |
| | C+6 | Loc. | 2 | | |
| | S+0 | Loc. | 1 | | |
| | S+3 | Loc. | 1 | | |
| | S+6 | Loc. | 1 | | |
| 7 | Stringing of power conductor including transportation and distribution of power conductor and accessories etc. | Km | 6 | | |
| 8 | Stringing of ground wire including transportation and distribution of ground wire and accessories etc. | Km | 6 | | |

| | | | | | |
|--------------------|--|---------|-----|--|---|
| 9 | Welding of all nuts and bolts upto the bottom crossarm level including all charges of transportation of materials etc. | | | | |
| | B+0 | Loc. | 7 | | |
| | B+3 | Loc. | 4 | | |
| | B+6 | Loc. | 3 | | |
| | C+0 | Loc. | 3 | | |
| | C+3 | Loc. | 2 | | |
| | C+6 | Loc. | 2 | | |
| | S+0 | Loc. | 1 | | |
| | S+3 | Loc. | 1 | | |
| | S+6 | Loc. | 1 | | |
| 10 | Painting of towers with bituminastic paints of approved quality upto 3 meter from the ground level where required including cost of paints.. | P/Tower | 24 | | |
| 11 | Fixing of plates: | | | | |
| | i) danger plate (2No/Tower) | P/Tower | 48 | | |
| | ii) phase plate (2No/Tower) | P/Tower | 144 | | |
| | iii) number plate (1No/Tower) | P/Tower | 48 | | |
| 12 | For power lines,telephone lines and stream/river crossing extra charges in addition to normal stringing charges. | | | | |
| | (a) Power line crossing | Span | 24 | | |
| | (b) Stream/river crossing over 335 meter | Span | 1 | | |
| | (c) Extra long span over 500 meter | Span | 2 | | |
| TOTAL 'C' | | | | | - |
| GRAND TOTAL | | | | | - |
| SAY | | | | | - |

(Rupees) only

Signature with Seal of the bidder

SECTION - V

ANNEXURE

ANNEXURE

Bank Guarantee for Advance Payment

We (hereinafter called as 'Bank') do hereby agree to pay on demand in writing from (hereinafter called 'the Owner') of any amount upto and not exceeding Rs. (Rupees) only to the owner on behalf of M/s (hereinafter called the 'Tenderer') who received an order for against tender No. dated (hereinafter called as the 'contract') and whereas the contract provides for payment as advance at the rate of 15% value of the contract by the owner to the Tenderer against this undertaking.

Whereas this guarantee shall be valid and binding on the Bank upto and including and the liability against this guarantee from Bank to the owner shall be limited to the amount remaining outstanding out of 10% advance payment after progressive adjustment of the same in the normal bills for progressive work by the Tenderer.

The liability of the Bank under this guarantee shall not be impaired or discharged by any extension of time or variations or alternations made, given, conceded to agree with or without the knowledge of the Bank by or between the owner and the Tenderer.

This guarantee shall remain in full force until and unless a suit or action to enforce a claim under the guarantee is filed against the Bank within 6 months from that date (ie.), all the rights of the owner under this guarantee shall be forfeited and the Bank shall be relieved and discharged from all liability thereon.

Dated this day of 20....

For and on behalf of the Bank
The above guarantee is accepted by me on behalf of P&E Department,
Govt. of Mizoram, Aizawl.

Engineer-in-Chief (P&E)
Mizoram : Aizawl

ANNEXURE

Form of Bank Guarantee

(In lieu of Contract/Performance Guarantee Form)

To,

The Engineer-in-Chief,
Power & Electricity Deptt.,
Govt. of Mizoram, Aizawl.

In consideration of the Engineer-in-Chief, Power & Electricity Deptt., Govt. of Mizoram, Aizawl (Hereinafter called 'the Purchaser', the expression of which shall, unless repugnant to the subject or context, include his successors and assigns) having agreed under the terms and conditions of order No..... Dated made between Power & Electricity Deptt., Government of Mizoram, and M/s (hereinafter called 'the said contract') to accept a Deed of Guarantee as herein provided for Rs. (Rupees) only from a Nationalised or Scheduled Bank in lieu of the Contract Performance Guarantee to be made by the Tenderer or in lieu the deduction to be made from the Tenderer's bills, for the due fulfilment, by the said Tenderer, of the terms and conditions contained in the said contract No..... we, the Bank and having its registered office at (hereinafter referred to as 'the said Bank') do hereby undertake and agree to indemnify and keep indemnified the Power & Electricity Deptt., Govt. of Mizoram from time to time to the extent of Rs. (Rupees) only i.e. 10% of the total contract value against any loss or damage, costs, charges and expenses caused to or suffered by or that may be caused to or suffered by the Power & Electricity Deptt., Govt. of Mizoram by reason of any breach or breaches by the said Tenderer of any of the terms and conditions contained in Clause 5.0 of the said contract and to unconditionally pay the amount claimed by the Purchaser on demand and without demur to the extent aforesaid.

2. We Bank further agrees that the Purchaser shall be the sole judge of and as to whether the said Tenderer has committed any breach or breaches of any of the terms and conditions of the said contract and the extent of loss, damage, costs, charges and expenses caused to or suffered by or that may be caused to or suffered by the Power & Electricity Deptt., Govt. of Mizoram on account thereof and the decision of the Purchaser that the said Tenderer has committed such breach or breaches and as to the amount or amount of loss, damage, cost, charges and expenses caused to or suffered by or that may be caused to or suffered by the Power & Electricity Deptt., Govt. of Mizoram from time to time shall be final and binding on us.

ANNEXURE

3. We, the said Bank, further agrees that the Guarantee herein contained shall remain in full force and effect during the period that would be taken for the performance of the said contract and till all the dues of the Purchaser under the said contract or by virtue of any of the terms and conditions governing the said contract have been fully paid and its claim satisfied or discharged and till the Purchaser certifies in writing that the terms and conditions of the said contract and accordingly discharges this Guarantee subject, however, that the Purchaser shall have no claim under this Guarantee after the expiry of the equipment Guarantee period of 12 calendar months as provided in Clause '**Guarantee**' of the said contract or from the date of cancellation of the said contract, as the case may be, unless a notice of the claim under this Guarantee has been served on the Bank before the expiry of the said equipment Guarantee period.

4. The Purchaser shall have the fullest liberty without affecting in any way the liability of the Bank under this Guarantee or Indemnity, from time to time to vary any of the terms and conditions of the said contract or to extent time of performance by the said Tenderer to postpone from any time and from time to time any of the powers exercisable by it against the said Tenderer and either to enforce or for bear from enforcing any of the terms and conditions governing the said contract or securities available to the Purchaser and the said Bank shall not be released from its liability under these presents by any exercise by the Purchaser of the liberty with reference to the matters aforesaid or by reasons of time being given to the said Tenderer or any other forbearance, act or omission on the part of the Purchaser or any indulgence by the Purchaser to the said Tenderer or any other matter or thing whatsoever which under the law relating to sureties would but for this provision have the effect of so releasing the Bank from its such liability.

5. It shall not be necessary for the Purchaser to proceed against the Tenderer before proceeding against the Bank and the Guarantee herein contained shall be enforceable against the Bank notwithstanding any security which the Purchaser may have obtained or obtain from the Tenderer shall at the time when proceedings are taken against the Bank hereunder be outstanding or unrealised.

6. We the Bank lastly undertake not to revoke this Guarantee during its currency except with the previous consent of the Purchaser in writing and agree that any change in the Constitution of the said Tenderer or the said Bank shall not discharge our liability hereunder.

Dated this..... day of 201....

For and on behalf of the Bank

The above Guarantee is accepted by me on behalf of P&E Department,
Govt. of Mizoram, Aizawl

Engineer-in-Chief (P&E)
Mizoram : Aizawl

