Technical Specification

Index

SECTION – 1

1. General requirement of specification (Technical)

1.1 General

This part covers technical conditions pursuant to the contract and will form an integral part of the contract. The following provisions shall supplement all the detailed technical specifications and requirement brought out in the accompanying technical specifications (Part-III). The contractor's proposal shall be based on the use of equipment and material complying fully with the requirement specified herein. It is recognized that the contractor may have standardized on the use of certain components, materials, processes, or procedures different than those specified herein. Alternate proposals offering similar equipment based on the manufacturer's standard practice will also be considered, provided such proposals met the specified design, standards and performance requirement and are acceptable to the purchaser.

1.2 Technical Qualifying Requirement

The Contractor must have executed similar works in hilly terrain i.e. he must have constructed either a 132 KV double circuit line of minimum length 20 km or a 132 KV single circuit line of minimum length 40 km in the last three years and these works should be working satisfactorily.

1.3 LIMIT OF CONTRACT

Equipment furnished shall be complete in every respect with all mounting, fitting fixtures and standard accessories normally provided with such equipment and/or needed for erection, completion and safe operation of the equipment as required by applicable codes though they may not have been specifically detailed in the technical specifications, unless included in the list of exclusion. A similar standard component / part of similar standard equipment provided, shall be inter changeable with one another.

1.4 ENGINEERING DATA

All the +s (except drawings of towers and tower foundations) of equipment being supplied by the contractor shall be submitted by the Contractor to Dy. General Manger (Engg.) for his approval. The Dy. General Manager (Engg.) shall approve the drawing and action for its inspection or waiver after receipt of the information of readiness of the material at works of the contractor and issue Dispatch Instruction. The design and drawings of towers and tower foundations shall be supplied by PTCUL, however the tower designs will have to be type tested by the Contractor.

The furnishing of engineering data by the contractor shall be in accordance with the schedule as specified in the technical specification. The review of these data by the Engineering will cover only general conformance of the data to the specifications and

documents, and of the dimensions which might affect plant layout. This review by PTCUL may not indicate a thorough review of all dimensions, quantities and details of equipment, material, any devices or items indicated or the accuracy of the information submitted. This review and/or approval by PTCUL shall not be constructed by the contractor as limiting any of his responsibilities and liabilities for mistakes and deviations from the requirement specified under these specifications and documents.

All Engineering data submitted by the contractor after final process including review and approval by PTCUL shall form part of the contract documents and the entire works covered under these specifications shall be performed in strictly conformity, unless otherwise expressly requested by PTCUL in writing.

1.5 DRAWINGS

1.0.0 All drawings submitted by the Contractor including those submitted at the time of tender shall be in sufficient details to indicate the type, size weight of each component, or any other information specifically requested in the specifications.

1.0.1 Each drawing submitted by the Contractor shall be clearly marked with the name of the Purchaser, the unit designation, the specification's title, the specification number and the name of the Project. All titles, noting, markings and writings on the drawing shall be in English.

1.0.2 The drawings submitted by the contractor shall be reviewed by PTCUL as far as practicable with the time schedule as mutually agreed and shall be modified by the contractor if any modifications and/or corrections are required by PTCUL. The Contractor shall incorporate such modifications and/or correction and submit the final drawings for approval.

1.0.3 The drawing will be sent for approval to PTCUL in five copies. One print of such drawing will be returned to the contractor, by the **Dy. General Manager (Engineering.) marked "Approved".** After approval of such drawing the contractor shall there upon furnish the owner with four prints.

1.0.4 Further work by the contractor shall be in strict accordance with these drawings and no deviation shall be permitted without the written approval of PTCUL, if so required.

1.0.5 All manufacturing and fabrication work in connection with the equipment prior to the approval of the drawing shall be at the contractor's risk. The Contractor may make any change, in the design which are necessary to make the equipment conform to the provisions and intent of Contract and such work with changes will again be subject to prior approval by PTCUL. Approval of contractor's drawings by PTCUL shall not relieve the contractor of any of his responsibilities and liabilities under this Contract.

1.6 MANUFACTURING SCHEDULE

1.0.0 The contractor shall submit to PTCUL his manufacture and delivery schedules for all material within thirty (30) days, from the date of letter of Award. Such schedules shall be in the line with the detailed net work for all phases of the work of the contractor. Schedules shall also include the materials and equipment purchase from outside supplier.

1.0.1 The contractor may submit the list of vendors and drawings of material to be supplied by him along with his offer. The corporation however may or may not accept any vendor and may propose the name of any other vendor.

1.7 REFERENCE OF STANDARDS

1.0.0 The codes, and/or standards referred to in these specifications shall govern, in all cases wherever such references are made. In case of any conflict between such codes and/or standards referred to shall mean the latest revisions, amendments Changes adopted and published by relevant agencies. In case of any further conflict in this matter, the same shall be referred to PTCUL, whose decision shall be final and binding.

1.0.1 It shall be the responsibility of the Contractor to ensure that the quality and specifications of the materials and works be as per the latest norms specified by the Bureau of Indian Standards, IEC, IEEE, etc. In case the parameters given in this specification are less stringent than the national or international norms or standards, it shall be the duty of the Contractor to point out the differences in due time and to gain explicit clarification and separate approval from PTCUL for the same .In case any standard is revised , it shall be the duty of the Contractor to point out the differences or revisions to PTCUL in due time so that the latest and more stringent specifications may be adhered to

1.0.2 The Codes and/or Standards referred to in Specifications shall govern, in all cases wherever such references are made. In case of a conflict between such Codes and/or Standards and the specifications, the Contractor must immediately point out the same to PTCUL and seek clarification about the same and in case PTCUL insists that notwithstanding the standards, the previously specified parameters be adhered to, get explicit approval from PTCUL for the same.. Such Codes and/or Standards, referred to shall mean the latest revisions, amendments/changes adopted and published by the relevant agencies.

1.0.3 Other internationally acceptable standards which ensure equal or high performance then those specified shall also be adopted, *subject to approval by PTCUL.*

1.8 DESIGN IMPROVEMENT

1.8.1 PTCUL or the contractor may propose changes in the specification of the equipments or quality thereof and if the parties agree upon any such changes, the specifications shall be modified accordingly.

1.8.2 If any agreed upon change is such that it affects the price and schedule of completion, the parties shall agree in writing as to the extent of any change in the price and/or schedule of completion before the contractor proceeds with the change. Following such agreement, the provision thereof shall be deemed to have been amended accordingly.

1.9 QUALITY ASSURANCE

1.0.0 QUALITY ASSURANCE PROGRAMME

To ensure that the equipment and services under the Scope of this contract whether manufactured or performed within the Contractor's work or at his Sub contractor's premises or at the purchaser's site or at any other place of work are in accordance with the specifications. The Contractor shall adopt suitable Quality Assurance Programme (QAP) to control such activities at all point, necessary. The quality Assurance Programme of the Contractor shall generally cover the following:-

b) His Organizational structure for the management and implementation of the proposed Quality Assurance Programme.
c) Documentation control system
d) Qualification data for bidder key personnel.
e) The procedure for purchase of materials, parts, components, and selection of sub contractor's services including vendor analysis, source inspection. Incoming raw-material inspection, verification of materials purchase. Etc.
f) System for shop manufacturing and site erection controls including process controls and fabrication and assembly controls.
g) Control of non-conforming items and system for corrective actions.
h) Control of calibration and testing of measuring and testing equipment.
i) Inspection and testing procedure both for manufacture and field activities.
j) System for indication and appraisal of inspection status.
k) System for quality audits.
l) System for authorizing release of manufactured product to the purchaser.
m) System for maintenance of records.
n) System for handling storage and delivery and
o) A quality plan detailing out the specific quality control procedure adopted for controlling the quality characteristics relevant to such item of equipment.

1.0.1 QUALITY ASSURANCE DOCUMENTS

The contractor shall be required to submit the following quality Assurance Documents within the three weeks of award of the Contract.

i) Material Test Report on components as specified the by specification.
ii) The inspection plan with verification, inspection plan check, point's verification sketches, if used and methods used to verify that the inspection and testing points in the inspection plan were performed satisfactorily.
iii) Factory test results for testing required as per applicable codes and standards referred in the specification Quality Assurance Documents 3 points

1.1 INSPECTION, TESTING AND INSPECTION CERTIFICATE

1.1.0 PTCUL's duly authorized representative and/or an outside inspection agency acting on behalf of the purchaser (PTCUL) shall at all reasonable times have access to the Contractor's premises or works and shall have the power, at all reasonable times to inspect and examine the materials and workmanship of the works during its manufacturer or erection and if part of the work is being manufactured or assembled on other premises or work, the Contractor shall obtain for PTCUL and for its duly authorized representative permission to inspect as if the works were manufactured or assembled on the contractor's own premises or works.

1.1.1 The Contractor shall give PTCUL or its authorized representative fifteen days written notice of any material being ready for testing. Such test shall be on the contractor's account except for the expenses of the inspector. PTCUL's Inspector, unless witnessing of the test is explicitly waived, will attend such test within Seven days of the date on which the equipment is notified as being ready for test/inspection.

1.1.2 PTCUL shall **within Seven (7) days** from the date of inspection as defined herein give notice in writing to the contractor of any objection to any drawings and all or any equipment and workmanship which in his opinion is not in accordance with the contract. The Contractor shall give due consideration to such objection and shall either make the modifications that may be necessary to meet the said objections or shall conform in writing to PTCUL giving reasons therein, that no modifications are necessary to comply with the contract.

1.1.3 When the factory tests have been completed at the contractor's or sub-contractor's work, PTCUL shall issue a certificate to this effect within Seven (7) days after completion of tests but if the tests are not witnessed by PTCUL. Inspection, the certificate shall be issued within Seven (7) days of the receipt of Contractor's test

certificate by PTCUL/Inspection. The completion of these tests or the issue of the certificate shall not bind the owner to accept the equipment, should it, on further tests after erection be found not to comply with the contract.

1.1.4 In all cases where the contract provides for tests whether at the premises or works of the contractor or any sub contractor, the contractor, except where otherwise specified, shall provide free of charge such items as labour, materials, electricity, fuel, water stores, apparatus and instruments as may be reasonably demanded by PTCUL's Inspector or PTCUL's authorized representative to carry out effectively such tests of the equipment in accordance with the Contract and shall give facilities to PTCUL or to its authorized representative in accomplishing testing.

1.1.5 The Inspection by PTCUL and issue of inspection certificate thereon shall in no way limit the liabilities and responsibilities of the contract in respect of the agreed quality assurance Programme forming a part of the contract.

1.1.6 After successful inspection and test, the purchaser shall issue a material dispatch clearance certificate authorizing the contractor to dispatch the inspected/tested material. No material shall be dispatched without issue of dispatch clearance certificate from the purchaser. In case inspection/test have been waived off by the purchaser even then contractor shall not dispatch the material without issue of dispatch clearance certificate.

1.1.7 The Contractor shall keep PTCUL informed in advance about the time of starting and of the progress of manufacture and fabrication of various parts at various stages, so that arrangements could be made for inspection

1.1.8 The acceptance of any part of items shall in no way relieve the Contractor of any part of his responsibility for meeting all the requirements of the specifications

1.1.9 PTCUL or its representative shall have free access at all reasonable times to those parts of the Contractor's works which are concerned with the fabrication of PTCUL's materials for satisfying himself that the fabrication is being done in accordance with the provisions of the Specifications

1.1.10 Unless specified otherwise, inspection shall be made at he place of manufacture prior to dispatch and shall be concluded so as not to interfere unnecessarily with the operation of the work

1.1.11 Should any member of the structure be found not to comply with the supplied documents, it shall be liable to rejection. No member once rejected shall be resubmitted for inspection, except in cases where PTCUL or its authorized representative considers that the defects can be recited

1.1.12 Defects which may appear during fabrication shall be made good with the consent of, and according to the procedure proposed by the Contractor and by PTCUL.

1.1.13 All gauges and templates necessary to satisfy PTCUL shall be supplied by the Contractor

1.1.14 The Contractor shall make provisions and arrangements for all documents, tools and plants, instruments, reference standards , literature ,drawings , engineers , technicians and manpower required for the conduction of the inspection

1.2 PACKING

All the equipments shall be suitably protected, coated, covered on boxed and crated to prevent damage or deterioration during transit, handling and storage at site till the time or erection. While packing all the materials, the limitations from the point of view of availability of Railway Wagon size in India should be taken into account. The Contractor shall be responsible for any loss or damage during transportation, handling and storage due to improper packing. The details furnished are for the guidance of Bidders. PTCUL takes no responsibility of the availability of wagon and variations in dimensions.

1.3 DESIGN CO-ORDINATION

The contractor may be responsible for the selection and design of appropriate equipments to provide the best co-ordinate performance of the entire system. The basic design requirements are detailed out in Technical Specifications. The design of various components, sub-assemblies and assemblies shall be so done, so that it facilitates easy field assembly and maintenance.

1.4 DESIGN COORDINATION MEETING

The contractor will be called upon to attend design co-ordination meeting with PTCUL. The Contractor shall attend such meeting at his own cost at Dehradun or at mutually agreed venue as and when required and fully co-operate with such persons and agencies involved during those discussions.

1.5 VENDORS

The contractor shall purchase bought out items from the approved vendors. In case, he wants any deviation he shall submit the details of such vendors for approval alongwith their detail within 1 month of L.O.A. otherwise it shall be assumed that he shall abide PTCUL may or may not accept his proposal.

2.0 PRICE VARIATION

The prices of all items are firm except Tower Structure, Nut Bolt, Conductor, Insulators and Earth Wire are variable as per formula given below : -

1.0 General

. If by reasons of any rise or fall in the cost of labour above or below such cost ruling on the date of Bidding, the price to be paid to the contractor for performing his obligations under the contract shall be increased or reduced, the amount of such increase or reduction shall be governed by the price adjustment formula (E) as prescribed in this part.

a. Price variation / adjustment shall be applicable only to those for which price adjustment formulas (E) have been prescribed in this section. Various items for which price adjustment formula (E) have not given; prices by the bidders shall be fixed prices and shall not be subjected to adjustment on any account during performance of the contract.

b. A Bid submitted with a fixed prices quotation for the item for which price adjustment is otherwise admissible shall not be rejected, but the price adjustment would be traded as Zero.

c. A Bid submitted with an adjustment prices quotation for the item for which price adjustment is not admissible shall be treated as non-responsive and rejected.

d. Prices for insurance and other charges, if any shall be firm and no price escalation shall be payable for these components.

e. If the price adjustment amount works out negative, then it would mean the amount to be recovered by the purchaser from the contractor.

f. In case, the measurement period of the works is delayed beyond such period as contract time schedule for reasons attributable to the contractor the price adjustment provision shall not be applicable for the period of time between the measurement period as per contract time schedule and actual period.

2.2 PRICE ADJUSTMENT FORMULA (E)

The formula for calculating the price adjustment to be supplied to the ex-factory price component of the fabricated tower parts (excluding Bolts and Nuts) shall be as follows:

(i) Transmission Line Tower using both heavy and lighter angles

$$\mathbf{P} = \frac{P_0}{100} \cdot \left[15+18\ \frac{HA}{HA_0} + 40\ \frac{LA}{LA_0} +16\ \frac{Zn}{Zn_0} +11\ \frac{W}{W_0}\right]$$

(ii) Transmission Line tower using only heavy angles

$$\mathbf{P} = \frac{P_0}{100} \cdot \left[15+58\ \frac{HA}{HA_0} +16\ \frac{Zn}{Zn_0} +11\ \frac{W}{W_0}\right]$$

(iii) Transmission Line Tower using only lighter angles

$$\mathbf{P} = \frac{P_0}{100} \cdot \left[15+58\ \frac{LA}{LA_0} +16\ \frac{Zn}{Zn_0} +11\ \frac{W}{W_0}\right]$$

Wherein

P = Price payable as adjusted in accordance with the above appropriate formula.

P_0 = Price quoted / conformed.

HA_0 = Price of heavy angles (refer notes)
This price is applicable on the first working day of the month, one month prior to the date of submission of Bid.

Zn_0 = Price of electrolytic high grade zinc (refer notes)

This price is applicable on the first working day of the month, one month prior to the date of submission of Bid.

W_0 = All India average consumer price index number for industrial workers, as published by the Labour Bureau, Ministry of Labour, Govt. of India (base 1982 = 100)

This index number is as applicable for the month four months prior to the date of tendering. For example, if the date of submission of Bid falls in July 2003, the applicable basic prices of heavy angles (HA_0) and / or lighter angle (La_0) and electrolytic high grade zinc (Zn_0) should be prevailing as on 1st June 2003 and all Indian average consumer price index number (W_0) should be for the month of January 2003.

The above price and indices are as published by IEEMA vide circular reference number IEEMA (PVC) TLT/_/_prevailing as on first working day of the month June i.e. one month prior to the date of submission of Bid.

HA = Price of heavy angles (refer notes)
This price is applicable on the first working day of the month, two month prior to the date of delivery

LA = Price of lighter angles (refer notes)
This price is applicable on the first working day of the month, two month prior to the date of delivery

Zn = Price of electrolytic high grade zinc (refer notes)
This price is applicable on the first working day of the month, two month prior to the date of delivery

W = All India average consumer price index number for industrial workers, as published by the Labour Bureau, Ministry of Labour, Govt. of India (base 1982 = 100

2.3 ERECTION PRICE COMPONENTS

The formula for calculation of the monthly price adjustment for erection price component as indicate shall be as under :

$$\mathbf{P_1} = P_O \left[0.25+3.0 \frac{D_1}{D_O} +0.45 \frac{L_1}{L_0} \right]$$

Where P_O = Quoted Price.

P_1 = Ultimate payable price

D_O = Price of High Speed diesel oil prevailing at Ex-Dehradun
One month prior to submission of Bid.

D_1= Price of High Speed diesel oil prevailing at Ex-Dehradun
As one first working day of the month in which the work is done.

L_O = All India Average consumer price index for Industrial workers as published by Central Labour Bureau, Shimla in Labour Journal one month prior to submission of Bid.

L_1 = All India Average consumer price index for Industrial workers as published by Central Labour Bureau, Shimla in Labour Journal applicable for the month in which the work is done.

Subscript ‘o’ will correspond to 30 days prior to date of opening of Bids for diesel oil and labour.

Subscript ‘T’ will correspond to the month of billing.

The total adjustment under this clause is not subject to any ceiling whatsoever.

2.4 PRICE VARIATION FOR EARTHWIRE

) For Earthwire :

The Price adjustment on the Ex-works price component, of Earthwire shall be as follows :

$$\mathbf{DEC_{EW} = EC_{EW}\ [0.74\ (A_1 - A_0) / A_0 + 0.11\ (L_1 - L_0) / L_0]}$$

Where

$\mathbf{DEC_{EW}}$ = Price Adjustment amount payable on Ex-works price of Earthwire

$\mathbf{EC_{EW}}$ = Ex-works price of Earthwire

A = Published price indices for high tensile steel galvanized wire, as published by CACMAI / Nationally recognized published index acceptable to PTCUL.

L = All India consumer price index for Industrial workers as published by Labour Bureau, Shimla (Govt. of India)

The basic cost applicable for claiming price variation shall be the ruling price of E.C. Grade Aluminium Wire Rods and high tensile galvanized steel wire rods as prevailing on the first day of current calendar month i.e. the calendar month in which the supplies are offered for inspection

1. The supplier shall furnish relevant CACMAI circulars (duly authenticated) whenever price revision is desired. The supplier shall also furnish the detailed calculations for the revised price.

2. No variation shall be allowed in respect of freight and insurance charges

2.5 PRICE VARIATION FORMULAS

FOR GI BOLTS & NUTS, GI STEP BOLTS & NUTS

The price variation shall be payable as applicable on ex-works price and shall be calculated on the basis of formula detailed below:

$$\mathbf{P1} = P_O\ [0.20 + 0.55\ \frac{S1}{S_O} + 0.15\ \frac{Z1}{Z_0} + 0.10\ \frac{L1}{L_0}\ ]$$

Where

P1 = Ex-works price payable per MT basis.

P_0 = Quoted Ex-works price on per MT basis.

S1 = Ex-works price in Rs/MT of steel angles (as per IS-2062) as applicable on first working day of the month two months prior to the date of dispatch based on IEEMA circulars.

S_0 = Ex-works price in Rs/MT of steel angles as per IS-2062 as published by IEEMA, as applicable on the first working day of calendar month one month prior to the date submission of bid submission.

Z1 = Ex-works price in Rs./MT of EC Grade Zinc (99.95%) as applicable on first working day of the month two months prior to the date of dispatch based on HZL/IEEMA circulars.

Z_0 = Ex-works price in Rs./MT of EC Grade Zinc (99.95%) as based on HZL/IEEMA circulars.

L1 = The average Labour index published by the Central Labour Bureau Shimla Government of India as prevailing on 1st working day of the month two months prior to the date of dispatch.

L_0 = The average Labour index published by the Central Labour Bureau Shimla Government of India.

The amount of MODVAT BENEFIT should be considered by the bidder in quoted prices.

The date of delivery shall be the date on which the material is notified as being ready for inspection.

2.6 FOR ELECTRO GALVANIZED WASHER

The price quoted / conformed is based on the cost of raw material / components as on the date of quotation and is deemed to be related to the rates for raw material index numbers for Iron steel and ferro alloys and all India average consumer price index number for industrial workers, as specified below. In case of any variation in these rates and index number, the prices shall be subject to adjustment up or down in accordance with the appropriate applicable formula given as under : -

$$\mathbf{P} = \frac{P_0}{100} \times \left(20 + \frac{60\ Fe}{Feo} + \frac{15\ w}{Wo} + \frac{5\ Zn}{Zno}\right)$$

Where in

P = Price payable as adjusted in accordance with the above price variation formula.

Po = Price quoted / conformed ex-works price.

Feo = Prices of medium and high carbon steel wire rods having carbon % as 0.75. In case of prices of high carbon steel ceased to be circulated by CACMAI the prices of steel angle as per IEEMA shall be considered as reference for medium and high carbon steel.

Zn = Price of Electrolyte high grade Zinc in rupees per MT as announced by HZL published in IEEMA.

Wo = All India average price index number for Industrial workers general index as published by the Labour Bureau Shimla Published in IEEMA Circular.

The above rates of any raw material are those published by IEEMA / CACMAI as prevailing / applicable on the 1st working day of calendar month one month prior to the date submission of BID.

The date of delivery shall be the date on which the washer is notified as being ready for inspection.

2.7 PRICE VARIATION CLAUSE FOR TRANSMISSION LINES ACCESSORIES AND HARDWARES (Applicable on Ex-works Price)

The price quoted / conformed is based on the input cost of raw material / components as on the date of quotation. It is deemed to be related to the rates of raw materials. Index number for iron, steel and ferro alloys and All India Average Consumer price Index Number for industrial workers as specified below. In case of any variation in these rates of raw material and index numbers, the price shall be subjected to adjustment up or down in accordance with the following formula : -

A. For Transmission Line accessories and hardwares containing both Aluminium and Steel:

$$\mathbf{P} = \frac{P_0}{100} \cdot \left[20+40 \frac{Al}{Al_0} +20 \frac{Fe}{Fe_0} +15 \frac{W}{W_0} +5 \frac{Zn}{Zn_0} \right]$$

B. For Transmission Line Accessories and hardwares containing all aluminium :

$$\mathbf{P} = \frac{P_0}{100} \cdot \left[20+65 \frac{Al}{Al_0} +15 \frac{W}{W_0} \right]$$

C. For Transmission Line Accessories and hardwares containing all Steel:

$$\mathbf{P} = \frac{P_0}{100} \cdot \left[20+65 \frac{Fe}{Fe_0} +15 \frac{W}{W_0} \right]$$

Where,

P = Price payable as adjusted in accordance with the above price variation formula.

Po = Price quoted / conformed ex-works price.

Al_0 = Price of EC grade Aluminium ingots in Rs/MT

Fe_0 = Wholesale price index number for Iron, Steel and Ferro Alloys as published by the office of the Economic Advisor Ministry of Industry Govt. of India, in their weekly bulletin, "**Revised index numbers of wholesale prices base 1970-71=100"**- Item.
For the week ending 1st Saturday of the relevant calendar month(2).

Zn_0 = "Price of electrolytic high grade zinc in Rupees per MT as announced by HZL(3).

W_0 = All India Average Consumer price Index number for industrial workers, general index, as published by the labour Bureau – Shimla.

The above rates of raw materials are those published by IEEMA prevailing as on the first working day of the calendar month, one month prior to the date of opening of

tender. The above prices are inclusive of excise duty and exclusive of any other Central State or Local taxes, Octroi etc. The applicable whole sale price index number for iron, steel and ferro alloy would be for the week ending 1st Saturday of the month two month prior to the date of submission of BID other applicable rates of materials, components. The All India Average Consumer price Index Number would be two months prior to the date of submission of BID.

Al = Price of EC grade Aluminium Rates of these raw materials are Ingots in Rs./MT published by IEEMA prevailing as on the 1st working day of the calendar month covering the date two months prior to the date of inspection.

Fe = Wholesale price Index number The applicable wholesale price index iron, steel and ferro alloys as number for iron, steel and ferro alloys published by the office of the would be that prevailing on 1st Sat. of Economic Advisor, Ministry of the month four months prior to the Industry Govt. of India (This date of inspection. index is also circulated by IEEMA)

W = All India Average consumer Consumer price index number index number for industrial worker for Industrial workers general index general index as published by as published by the Labour Bureau the Labour Bureau, Chandigarh Chandigarh would be for the Month This index is also circulated by four months prior to the date inspection IEEMA

If the date of delivery in terms of clause given below falls in December 1999 the applicable raw material prices would be those, as published by IEEMA prevailing as on 1st October 1999 and the applicable index number Fe will be as applicable for the week ending 1st Saturday of August 1999 and it will be for the month of August, 99.

The date of delivery shall be the date on which the accessories / hardwares is notified as being ready for inspection.

1) Whole sale price index number for iron steel and ferro alloys as published by the office of the Economics Advisor, Ministry of Industries, Govt. of India in their weekly bulletin revised index number of wholesale price (base 1970-71=100) – item (*)(i) for the week ending 1st Saturday of the relevant calendar month.

The index number for iron, steel and Ferro alloys is published weekly but if there are any changes, the same are in corporated in the issue appearing in the following week. For the purpose of this price variation clause the final index number shall apply. This index is also circulated by IEEMA

2) The price of electrolyte high grade zinc shall be HZL sale price for electrolytic high grade zinc in Rs/MT and as circulated by IEEMA as prevailing on the first day of the calendar month. This is the ex-godown price for Bombay/Calcutta/Madras

2.8 PRICE VARIATION FOR ACSR ZEBRA CONDUCTOR

Price of ACSR Zebra Conductor which shall be variable as per CACMAI circulars The price payable shall be subject to adjustment upwards or downwards in accordance with the following formula :

A = [(U-V) x wt of Aluminium (in MT) used in per km of ACSR Zebra conductor + (Y-X) x wt of steel used (in MT) used in per km of ACSR Zebra conductor]

Where :

V = Rates of E.C. grade aluminium wire rod per MT announced by CACMAI on base date i.e. one month prior to the submission of bid.

U = Rates of E.C grade aluminium wire rod per MT announced by CACMAI which is in force one month prior to the date of offering of inspection.

X = Rates of 3.18mm size high tensile galvanized steel wire per MT announced by CACMAI base date one month prior to the submission of bid.

Y = Rates of 3.18mm size high tensile galvanized steel wire per MT announced by CACMAI which is in force one month prior to the date of offering of inspection.

A = Difference in prices/Km of ACSR Zebra conductor due to enhanced prices of E.C. grade aluminium wire rod & 3.18mm size high tensile glavanized steel wire.

In above formula rates of E.C. grade aluminium wire rod & 3.18mm size high tensile glavanized steel wire shall be exclusive of Excise Duty & Sales Tax. Weights of aluminium & steel shall be as per GTP of the conductor.

2.9 PRICE VARIATION FOR INSULATOR

The Price variation payable for Insulator shall be in accordance with the formula given below:

$$\mathbf{P} = \frac{P_0}{100}\left(15 + 5\frac{Zn}{Zn_0} + 53\frac{IN\text{-}INSLR}{IN_0\text{-}INSLR_0} + 27\frac{W}{W_0}\right)$$

Wherein,

P = Price payable as adjusted in accordance with the price variation clause.

Po = Price quoted / conformed.

Zn_0 = Price of electrolytic high grade zinc in rupees per MT as announced by HZL.

INo-INSLR = Index No. for insulators based on relative prices and weightages (as in brackets) of whole sale price index number foe fuel, Power, Light and Lubricant (28), wholesale price index number for basic metals, Alloys and metal products (15) whole sale price index number for Wood Products (6) and Ball Clay (4) calculated considering their values as on 1st January 2003 as base equal to 100 (refer notes).

Wo = All India average consumer price index No. for industrial workers, as published by the Labour Bureau , Ministry of Labour, Govt. of India (Base 1982=100). This index number is as applicable for the month **two** month prior to the date of tendering.

For example, if the date of fall in May 2003, price of Zinc and the applicable index number for insulator (IN□--INSLR) should be that prevailing as on 1st April 2003 and the applicable all India average consumer price index number (W□) should for the month of February 2003. The above indices are as published by IEEMA vide IEEMA circular reference number IEEMA (PVC)/INSLR/_/_ Prevailing as on first working day of the month …… i.e. **one** month prior to the date of tendering.

Zn = Price of electrolytic high grade zinc (refer notes)
This price is as applicable on the first working day of the calendar month. Two months prior to the date of delivery.

IN – INSLR= Index No. for insulators based on relative prices and weightages (as given in brackets) of whole sale price index number foe fuel, Power, Light and Lubricant (28), wholesale price index number for basic metals, Alloys and metal products (15) whole sale price index number for Wood Products (6) and Ball Clay (4) calculated considering their values as on 1st January 2003 as base equal to 100 (refer notes).
This price is as applicable on the first working day of the calendar month. **One** months prior to the date of delivery.

W = All India average consumer price index for the industrial workers. (The applicable all India average consumer price index no. would be for the month, two months prior to the date covering applicable rate of zinc..

e.g. if the date delivery in terms of clause given below falls in December 2003, the applicable price of Zinc would be that prevailing for the month of Oct. 2003 & Index W will be for the month of Aug.2003.

The date of delivery shall be the date on which the insulators are notified as being ready for inspection / dispatch. (in the absence of such notification, the manufacturer's dispatch note shall be considered as date of delivery or the contractual delivery date, which ever shall be earlier.)

3.0 SPECIAL CONDITIONS OF THE CONTRACT

2.1 GENERAL

These Special Conditions of this contract shall be read and construed alongwith General Conditions given in Form 'A/B' annexed. However, in case of any conflict or inconsistency between General conditions of contract form 'A'/B and these Special Conditions of the contract, the provision of Special Conditions of Contract to the extend of such conflict and inconsistency shall prevail.

2.2 SCOPE OF THE CONTRACT

1.8.1 This contract covers the **Diversion work of 14 Km 220 KV S/C Line from RISHIKESH-DHARASU & CHAMBA-DHARASU LINE IN TEHRI DAM Submerged to be done on turnkey basis.**

2.3 DETAIL OF WORKS

2.3.1 The scope of the works for the above transmission lines covered under this contract shall be here under :

i) Survey (Preliminary and final) peg marking, preparation of profile, stub setting, design & erection of all type of towers including special structures, fixing of accessories, stringing of conductors, stringing of earth wire testing and commissioning of erected line etc.

ii) Supply of fabricated and galvanized lattice Towers, Galvanised Templates, Nuts & Bolts, and Washers.

iii) Supply of conductor, earthwire, insulators, hardware's, tower accessories complete in all respect.

iv) All material related to civil works and constriction of foundations & stub setting, revetment etc.

v) Supply of complete material required for completion of work.

vi) Arrangement of Erection tools.

vii) Taking delivery and proper storage, safe custody of various items i.e. tower parts, bolts & nuts, tower accessories, special structures, conductor, earthwire, line material, cement etc. and their use in erection and stringing of transmission line.

viii) Arrangement of storage cum Erection Insurance Policy for all the line material for TURNKEY construction of transmission lines upto the end of completion & Commissioning of transmission lines.

ix) Testing and commissioning of the lines.

x) Forest case shall be prepared by the contractor.

2.4 COMMENCEMENT OF ACTIVITIES

2.4.1 Commencement of the following activities is subject to the prior and specific approval by the Dy. General Manager(Engg.) PTCUL and receipt of approved data / documents as follows :

(i)	Route profile	Tower spotting data and sag template.
(ii)	Foundation Work	Stub setting template, foundation designs, classification of foundation.
(iii)	Erection of tower	Quality assurance plan for erection
(iv)	Stringing of wires	Stringing charts and stringing.

2.4.2 ENGINEER INCHARGE OF CONTRACT

Dy. General Manager (Engg.) PTCUL shall be Engineer in charge of the contract. The line route, profiles, classification of foundation and other field activities shall be approved by him. His decision in all field activities shall be final.

2.5 DRAWINGS

2.5.1 The Contractor shall do the construction work strictly in accordance with approved drawings and no deviation shall be permitted without approval in writing from the Dy. General Manager (Engg.) PTCUL, if so required.

2.5.2 The Contractor shall submit One set of drawings of final route survey and profile etc. with necessary details as mentioned in Technical specification for approval of the Dy. General Manager (Engg.) PTCUL. After scrutiny of the drawings by PTCUL and after incorporating all the modifications as mutually agreed the contractor will submit the final drawings for final approval. PTCUL will formally approve the tracing and contractor will supply two copies of approved drawings.

2.5.3 On the completion of erection work, the Contractor will supply to the Supervising Engineer free of cost, the complete as executed drawings of the line(s) showing each and every structure as actually erected, roads, railway

crossing, all major or small river crossing etc. together with measured spans. At all deviation points, the angle shall be marked in degrees. All Kutcha and metal roads, trees structures, ponds and other obstructions etc. within 30 meters on either side of the route shall be clearly indicated. The drawings shall also show telecommunication or power lines within 30 meters on either side of the lines. The drawings shall be drawn in ink of good quality on tracing paper assuming a scale of 20 Mtr. = 1Cm. horizontal and 2 Mtr.=1 Cm vertical.

2.6 COMPLETION PERIOD

2.6.1 The lines shall be completed within **6 months** from the date of letter of award. The successful bidder shall have to furnish the Bar Chart indicating therein different activities and their target to achieve the delivery period.

2.6.2 The Contractor would however, endeavor to complete the above transmission line well in advance of the above date as the line is urgently required.

2.7 SPECIAL NOTE

It may be very clearly be noted by all that no modifications in price reduction clause No. 27 of Contract form 'B' shall be accepted i.e. broadly a price reduction of 1/2% per week subject to maximum of 10% of the contract value shall be applicable, in case of supply not being satisfactory and conforming to specification and as per delivery schedule it will be at the discretion of the corporation to cancel the order besides price reduction as per clause 27 of form 'B' from the pending bills or by other means found.

2.8 VARIATION

The quantities given in price schedule are tentative and indicative only and individual work/supply may vary to any extent according to site position, however total variation on higher side shall only be +20% of the contract value.

2.9 SPECIAL WORKS

The rates for work not included in the Schedules will be decided upon, when any such necessity arises during the execution of the work, by negotiations between the Supervising Engineer and the Contractor. The contractor shall perform the work on the terms and conditions as mutually agreed upon.

2.10 MATERIAL TO BE ARRANGED BY CONTRACTOR

a) This Being a turn key contract all the material including, fabricated galvanized towers, Zebra conductor, 160 KN and 90 KN insulators 7/3.15 mm earthwire, tower accessories, accessories of ACSR Zebra conductor and 7/3.15 mm Earthwire, and all the hardware fittings, like Tension/suspension fittings for ACSR Zebra conductor Tension/suspension clamps for 7/3.15 mm. Earth wire, shall be arranged by the Contractor. Stone blast, sand, cement, stone pad M.S. steel bars required for R.C.C. foundation etc. to be used in foundation work shall be arranged and supplied by the Contractor without any extra charges to the Corporation. Earthing material shall also be arranged by Contractor.

b) Tools & Plants required for construction of the transmission lines at various stages shall be arranged by the Contractor at his own cost.

c) Mild Steel bars conforming to IS:226 for R.C.C. foundations shall be arranged by the Contractor. Payment for such bars shall be made as per rates specified in the price schedule.

d) Any other material, tools and plants etc. besides those are to be arranged by the by Corporation as may be necessary for construction of the transmission lines shall be arranged by the Contractor at his own cost.

e) All the material required under the scope of this contract but not covered specifically in above clause shall be arranged and supplied by the Contractor without any extra cost to corporation.

2.11 UNACCOUNTABLE WASTAGE

The contractor shall make every effort to minimize the breakage, losses and wastage of line material during erection of the Corporation supplied items. However, the Contractor will be allowed unaccountable wastage and losses during erection not exceeding the following values given against each item:

i) Insulator	1.0%
ii) Conductor	1.0%
iii) Hardware Fitting	0.5%
iv) Conductor & Earthwire Accessories	0.5%

The conductor length upto 30 meter will be treated as good conductor lengths. On completion of work, the Contractor will return the balance items over and above

actually used on each line. Wastage (conductor having length less than 30 meters) shall also be returned on as is where is basis at Corporation's store at Rishikesh.

The Contractor shall not be required to return to PTCUL empty conductor and Earthwire drums and shall dispose off the same at his cost.

Permitted Extra Consumption of Line Materials

The quantity of conductor and Earth wire to be incorporated in the line shall be worked as per the following norms.

Quantity of Conductor	=	Line Length* as per detailed survey x 3 (For single Circuit Line).
Quantity of Earthwire	=	Line Length* as per detailed survey x no. of Earthwire.

For calculation of Conductor and Earthwire requirement in hilly stretches, inclined distance between the towers may be considered instead of horizontal distance (considered for line length). Jumper length will measured separately and will be added to actual line length.

The Contractor shall make every effort to minimize breakage, losses and wastage of the line materials during erection. However, the Contractor shall be permitted and extra consumption of line materials up to the limits specified.

2.12 PERMITS AND PRIORITIES

2.12.1 Necessary permits, if any, required for the execution of the contract shall be arranged by the Contractor himself. However, the Corporation may assist the Contractor for obtaining permits required for operation of the vehicle etc. during construction work of the line.

2.12.2 The Corporation shall not be responsible for the delay in execution of contract if permits and priorities are not granted in time.

2.13 RECEIPT OF MATERIAL AT SITE

The contractor shall be responsible for the proper handling and maintenance of the materials received by him from the date of their receipts till the end of maintenance period in accordance with the general conditions of Contract given Form 'A' enclosed.

2.14 STORAGE OF MATERIAL

2.14.1 The Contractor shall be required to set up stores at suitable place(s) along the route of the line to receive and store the materials, within 15 Days of the issue of Letter of Award or as such as the first lot of fabricated tower parts for the line received.

2.14.2 The Contractor shall make arrangement to take delivery of all the materials and stock them properly.

2.14.3 Yards and stores for stocking provided by the Contractor shall be open for inspection by the Corporation's staff as & when desired by the Corporation.

2.14.4 The cost of handling and storage of materials is included in the quoted erection rates entered in the Price Schedule.

2.14.5 The store shall be kept insured as per provisions of this Contract.

2.14.6 The contractor shall keep PTCUL informed about the locations of their stores.

2.15 REPLACEMENT AND SHORTAGES

2.15.1 Any material supplied by the Contractor and found defective shall be replaced free of cost by the Contractor.

2.15.2 Any erection work done, if done defectively, shall be rectified free of cost by the Contractor.

2.16 ERECTION TOOLS

All the erection tools and plant required for and during the construction of the line shall be arranged by the Contractor at his own cost. The Contractor shall ensure that tools and plants required for the erection of all transmission lines are available with him sufficiently in advance. No delay in completion period will be accepted if necessary tools and plants are not arranged by the Contractor in time.

2.17 USE OF ROADS

The Contractor may be allowed to use Private road in connection with the construction work. The Corporation may also help in obtaining permit for using canal service roads for transport of Contractor's man and materials, wherever possible under the rules. Any charges levied by the concerned authorities for use of Canal roads etc. shall be borne by the Contractor. This will, however, not be binding on the Corporation and no delay in start or completion of work shall be accepted on this account.

2.18 SAFETY OF STAFF & LABOURERS

The Contractor shall provide and make all necessary arrangements for safety of staff and labourers at site of work. The Corporation will not, in any way, be responsible for

any accident minor, major or fatal, to any person at the site of work or for any damage arising there from during the erection, which shall be contractor's responsibility. The staff insurance charges, if any, shall also be borne by the Contractor.

2.19 INSPECTION & INSPECTION CERTIFCATE

2.19.1 PTCUL, through its duly authorized representative shall have at all reasonable times access to the contractor's premises, stores or works and shall have the power, at all reasonable times to inspect and examine the materials and workmanship of the works during its erection. They will be given all help by the contractor for carrying out such inspection.

2.19.2 The inspection by PTCUL/Supervising Engineer or their authorized representative and issue of inspection certificate thereon shall in no way limit the liabilities and responsibilities of the Contractor in respect of agreed quality assurance programme forming a part of the Contract.

2.20 WAY LEAVE & TREE CUTTING & OTHER CLEARANCE

2.20.1 Any Right of way, which may be required by the Contractor, shall be arranged by PTCUL, except for approach roads, on intimation from the Contractor after submission of the final alignment, proposals for Right of Way, shall be submitted by the contractor well in advance to avoid delay. Permission will be obtained by PTCUL within reasonable time, for which due notice shall be given by the Contractor.

2.20.2 Tree cutting should be avoided as far as possible. However, if the tree cutting is necessary it shall be done by the contractor. For this purpose, complete details of the type and size (diameter / circumference) and other relevant/ required details with number of trees alongwith name owner thereof, duly verified by local district/ Revenue authorities shall also be submitted by the Contactor within 30 days of the final survey.

2.20.3 PTCUL shall not be held responsible for any claim on account of damage done by the Contractor or his gangs to trees, crops or other property without authority form PTCUL.

2.20.4 In case of anticipated damage of crops, the details of fruits bearing trees and other crops, area, plot numbers and name of owners etc. duly verified by district/ revenue authorities shall be submitted by the Contractor **well** in time.

2.20.5 In the event of any obstruction being encountered **from** the local villagers or authorities the Contractor shall immediately notify the Corporation, who shall take such steps as may be necessary to clear the obstruction. The Contractor or his representatives or gangs shall immediately report to PTCUL any case of obstruction which cannot be settled amicably. They will not adopt any antagonistic attitude towards the local people they come in contact with.

2.20.6 Payment of compensation towards the clearance etc. will be the responsibility of the contractor.

2.20.7 The Contractor shall take all possible steps to see that unavoidable damage to standing crops etc. is kept to a minimum.

2.20.8 **FOREST CASE**

Contractor shall prepare Forest Case in Civil, Private Forest Land and his scope will be preparation of case, all efforts approvals from Revenue, Forest or any Government authorities will be in scope of Contractor. Any compensation to Forest Authorities will be disbursed by PTCUL. The crop compensation shall be Contractor's responsibility.

2.20.9 The Contractor shall prepare necessary proposals including supply of necessary data and documents required in connection with the clearance relating to the following :

a) PTCC Clearance.
b) Clearance from Air Port / Fields

2.20.10 The Contractor shall **inform PTCUL** about the places where there is any problem, including Forest as sufficiently in advance, so that required clearance can be arranged in time The board shall not be held responsible for any claim on account of damage done by the Contractor or his gangs to trees, Crops or other property without authority from the Supervising Engineer. The Supervising Engineer in this contract shall be DGM(Project), for this purpose.

2.20.11 The Contractor shall take all possible steps to ensure that crops, damages etc. is kept to a minimum and in the event of extensive damage to ripe or partially developed crops.

2.21 COMPLIANCE WITH REGULATIONS

2.21.1 Unless otherwise specified all work shall be carried out in accordance with the Indian Electricity Act, 1910, Indian Electricity rules 1956 & The Indian Electricity Act 2003 with any amendments or revisions thereof, which may be issued during the currency of the contract and the requirement of any other Regulation and Act in India to which the corporation may be subjected to.

2.21.2 All power / communication line, or other important road crossing etc. or routing the line through air field region shall conform to the relevant rules and procedures laid down by railway, communication, Aviation or other concerned authorities.

2.21.3 The Contractor shall also be governed by the acts relating to conservation of forest, while routing the transmission line.

i) Necessary care should be taken to avoid delay on account of obtaining forest clearance.

ii) Supervise the quality assurance programme implementations at all stages of the works.

2.22 TRAINING OF CORPORATION'S STAFF

The Corporation reserves the right to attach its own staff comprising of engineer and subordinates with the contractor's erection staff for the purpose of gaining experience and the Contractor shall extend all facilities for this purpose. The contractor shall not however be required to incur any expenditure on this account.

2.23 RESPONSIBILITY OF THE CONTRACTOR & COMPLETENESS

2.23.1 The Contractor shall guarantee and be entirely responsible for the execution of the Contract in accordance with the General Conditions of Contract Form 'A' Special Conditions, Specifications, annexures and Schedules, appendices, other documents and all clauses of this contract.

2.23.2 The Contractor shall guarantee and be entirely responsible for taking delivery of all materials, storage, cartage, proper handling and storage of all materials at site testing and commissioning and maintenance of the said line, insurance during storage till the line is taken over by the Supervising Engineer.

2.23.3 He shall further guarantee and be responsible for the quality and workmanship of completed work, conformity of all works to the approved designs and drawings, and their proper erection within the guaranteed completion and maintenance period, till the line is taken over by the Corporation.

2.23.4 The Contractor shall be responsible for the timely submission of profiles, type of foundations etc, since the erection of the lines is related with them. As such he shall also be responsible for obtaining the approval of profiles, types of foundation etc./ within the schedule time. In this connection, if necessary he will depute his representative to sort out the matter with the Supervising Engineer.

2.23.5 The Corporation shall have the right to require the Contractor to make any change in the erection practices, which may be necessary in the opinion of PTCUL/Supervising Engineer to make the towers and other materials and work conforming to the provisions and contents of the specification, without extra cost of the Corporation.

2.23.6 Approval by PTCUL or by any authorized representative of the Corporation of the Contractor's or Sub- Contractor's drawings, material or of other parts of work involved in the contract, or of tests carried out either by the Contractor or

by the Sub- Contractor or Corporation shall not relieve the Contractor of any part of the Contractor's obligations of meeting all the requirement of the specifications.

2.23.7 Any work performed prior to the approval of drawings, tests etc. will be at Contractor's risk.

2.23.8 Contractor shall submit revetment drawings with Supervising Engineer for approval by DGM(Engg.) and work shall be carried out as per approved drawings. Any deviation from same shell be at contactor risk. All revetment drawing shell be developed by the contactor.

2.24 PROJECT MONITORING

2.24.1 After the award of contract, the Contractor in consultation with PTCUL / Supervising Engineer shall prepare a detailed time schedule for each activity and relating various activities with each other in chronological sequence.

2.24.2 The time schedule shall be submitted in the following formats:

a) Bar Chart giving broad schedules of main activities such as finalization of designs and drawings, tower testing, procurement of materials, manufacture and supply of tower parts, construction of foundations erection of towers, erection of line material, stringing and testing commissioning. In this chart, both commencement and completion dates of each activity are to indicated.

2.24.2.1 During the execution of the Contract, the Contractor shall furnish the following reports to PTCUL / Supervising Engineer:

a) Weekly progress report of various activities of erection of line as well as receipt of various materials at site, indicating actual progress during the fortnight as well as cumulative.
b) Monthly progress report for the designs and engineering activities giving scheduled and actual progress of the submission, scrutiny and approval of the various drawings, profiles and charts etc.
c) Any other progress report daily/weekly as desired by the Purchaser.

2.24.3 The format for the above progress reports shall be as per enclosed Annexure.

2.24.3.1 Besides above, a periodical review meeting between Contractor and Supervising Engineer or his authorized representative shall be held to analyze the Schedule and actual progress, targets for the next period and to sort out bottlenecks, if any. The Contractor will attend the above meeting along with necessary information in respect of supply and erection activities.

2.24.4 In case the Contractor repeated fails to givethe above progress reports or if the progress of supplies or works falls behind the mutually agreed work schedule/bar chart by more than three weeks, PTCUL may initiate punitive action against the Contractor and may also initiate action to get the work done by another firm,without any further delay, completely at the cost and risk of the Contractor

3 SCHEDULE OF MILESTONES AND TERMS OF PAYMENT

3.1 The payment of supplies and works shall be made in slabs as per milestones as described below. Completion of key activities shall be considered as milestones as listed below and for each milestone a certain percentage of the total payment shall be payable, as tabulated below :

Sl. No.	Activity/Name of Milestone	Percentage of the total amount payable
1	Mobilisation advance	10%
2	Detailed survey, Profiling and Preparation of forest case	5%
3	Supply of stubs and templates	5%
4	Casting of foundations	10%
5	Supply of towers	20%
6	Supply of conductor and hardware fittings	20%
7	Tower Erection	20%
8	Stringing, testing and commissioning	10%

3.2 The full payments for the mobilization advance, detailed survey, profiling survey, profiling, preparation of forest case, supply of stubs and templates, stringing, testing and commissioning shall be made once for each milestone.

3.3 The payments for he other milestones shall be made in slabs of 20% i.e. when 20% of the work of the milestone is completed, then 20% of the amount allocated for that milestone shall become payable.

3.4 The supply of towers shall commence after 20% of the total number of foundations are cast and payments for tower supply shall be made when 20% of the total number of complete towers are received.

3.5 Similarly, the supply of conductor and hardware shall begin when 20% of the total numbers of complete towers have been erected.

3.6 90% of the amounts payable as per the above milestones, whether for work or supply, shall be made to the Contractor against monthly running bills and balance 10% after expiry of maintenance period. The balance amounts shall be paid as per the SBD.

5.0 TECHNICAL CONDITIONS OF CONTRACT

1.0 PROJECT DESCRIPTION

1.0.0 The Power Transmission Corporation of Uttarakhand Ltd proposes the **Diversion work of 14 Km 220 KV S/C Line from RISHIKESH-DHARASU & CHAMBA-DHARASU LINE IN TEHRI DAM Submerged area to be done on turnkey basis.**

as mentioned in the Price Schedule and this section of the Contract covers the technical specification in connection with the erection of transmission lines on turnkey – basis.

1.0.1 The approximate quantities of tower extension, templates, accessories etc. are given in the Bid Price Schedule. The exact quantities will be worked out after detailed survey.

1.1 CLIMATIC CONDITIONS

The line passes through an area where the climatic and isoceraunic conditions are as given below:

LOCATION - RISHIKESH-DHARASU & CHAMBA-DHARASU

i)	Max ambient Temp	50^0 C.
ii)	Minimum Ambient Temp.	5^0 C
iii)	Relative Humidity	100% Max, 10% Min.
iv)	No. of Monsoon month	June to September
v)	Average annual rainfall	2200 mm

vi)	Seismic Level	0.139
viii)	Wind Zone	4

1.2 MATERIAL AND WORKMAINSHIP

1.2.0 Unless otherwise specified, all material used shall be of out door type, of the best quality and workmanship, capable of satisfactory operation under the operating and atmospheric conditions specified. Unless otherwise specified, they shall conform in all respect to the requirement of the latest edition of the relevant Indian Standard Specification on that behalf. Wherever Indian Standard Specifications have not been formulated British Standard Specification or IEC shall apply.

1.2.1 The material **is** to be arranged by the Contractor, this being a turnkey project.

1.2.2 All materials shall be erected after being approved and passed by the Supervising Engineer. The erection of the line shall be done according to the best practices being followed in erection of High Voltage Line with the best erection equipments so as to give satisfactory result.

2 PTCUL's Environment and Social Safeguard Policy and its Implementation.

6.1.1 Non judicious and unwarranted use of natural resources albeit in man's quest for development and growth of mankind through industrialization has had considerable impact on the environment and society. As a result, environmental and social issues have emerged as focal points of global debate. PTCUL's activities by their inherent nature and flexibility have negligible impacts on environment. PTCUL has evolved its Environmental and Social Policy and Procedures (ESPP).

6.1.2 Objectives of the environmental and social policy of PTCUL:

- Sustainable use and conservation of natural resources.
- Efficient and safe technology practices.
- Minimiztion of losses in energy during transmission.
- Minimization of social impacts such as displacement of people and adverse effects on their livelihood.

6.1.3 The key principles of PTCUL Environmental and Social Policy are :

ii) Avoidance of environmentally and socially sensitive areas while planning project activities.

iii) Minimization of impacts when project activities occur in environmentally and socially sensitive areas.

iv) Mitigation of any unavoidable adverse impacts arising out of its projects.

1.0 Basic issues to be kept in mind while carrying out construction activities are to

i) Avoid socially sensitive areas with regard to human habitations and areas of cultural significance.

ii) Secure the interest of people affected by PTCUL's projects.

iii) Involve local people affected by transmission line projects as per requirement and suitability.

iv) Consult affected people in decisions having implication to them if considered necessary.

v) Apply, efficient and safe technology/practices.

vi) Keep abreast of all potential dangers to people's health, occupational safety and safety of environmental and the respective mitigatory measures.

vii) Establish preventive mechanisms to guarantee safety.

viii) Mitigation measures in case of accidents.

ix) Avoid unwarranted cutting of trees in forest area.

1.1 While constructing the lines through forest stretches the Contractor will provide alternate fuel to its employee e.g. working labours/supervisors etc. in order to avoid cutting of forest woods.

1.2 Contractor will ensure safety to the wild life, during working/camping near to the National park.

1.3 Contractor during construction of lines in agricultural fields will ensure minimum damages to the crops, trees, bunds, irrigation etc. If the same is un-avodiable, the decision of Engineer in-charge shall be final.

1.4 The waste/excess material/debris should be removed form the construction site including agricultural field, forest stretches, river etc. immediately after construction work in a safe manner.

1.5 The Contractor will ensure least disturbance to the hill slope and natural drainage so as to avoid soil erosion. Natural drainage in plain area if disturbed to be trained to the satisfaction of Engineer in-charge.

1.6 As far as possible existing path/kutchha road/approach shall be used for the construction.

1.7 The Contractor will ensure supply of stone chips/sand form authorized/approved quarry areas.

1.8 No waste materials or by-products shall be released into the environment where they or the products of their combustion, decomposition or any of the products formed after their interaction with the environment may damage the soil, water bodies, atmosphere or any other element of the environment or have any harmful effects on the health of human beings, flora or fauna.

1.9 The Contractor shall take suitable steps to keep the noise levels within acceptable limits so as not to disturb human beings or animals.

1.10 All precautions shall be taken by the Contractor to avoid the occurrence of any forest fire.

1.11 All precautions shall be taken by the Contractor to prevent wastage of water.

1.12 All precautions shall be taken by the Contractor to prevent the wastage of energy or fuel.

1.13 The Contractor shall make provisions for safe and proper relocation of the excavated soil.

1.14 The Contractor shall ensure proper documentation of above.

1.15 Relevant regulatory and legal aspects of environmental issues shall have to be borne in mind.Techno-Economic Clearance by CEA under Electricity (Supply) Act 1948 and Forest clearance under the Forest (Conservation) Act, 1980 Are mandatory environmental requirements of the Nation & State of Uttarakhand which shall have to be obtained..Prescriptive framework (National & Uttarakhand State) in the form of Constitutional Guarantees and Applicable Legislations shall have to be fully complied with. As also will be the relevant policies such as the National Conservation Strategy and Draft policy Statement on Environment and Development, 1992 and draft policy statement fro abatement of pollution 1992.In case any National Park , reserve forest , wildlife sanctuary or biosphere reserve are encountered ,the approval of the Hon'ble Supreme Court approval for the effected forest land in above Wild Life Sanctuaries shall be required.

1.16 The laws and regulations pertaining to social aspects will have to be followed. Notification under Section 29 of the Electricity (Supply) Act, 1948, (Public Consultation Components), Rights of Way and Compensation Under Electricity Laws and Provisions Under Land Acquisition Act, 1894, as amended in 1984 are mandatory requirements (National & Uttarakhand State) ..Prescriptive Framework (National & Uttarakhand State) such as Constitutional Guarantees, State-wide Laws and Policies Relating to Land Acquisition and Issues of R&R – Rehabilitation Draft policy December 1998 (THDC) must be complied with. Relevant policies regarding Draft Uttarakhand State Draft policy for Rehabilitation of Persons Displaced as a Consequence of Acquisition of Land, Draft NGO Position Paper, in response to the above, Definition of Projects affected persons (PAPs) and Nature and extent of entitlements have to be considered and complied with

1.17 COMPLETION SCHEDULE

1.17.0 The time and date of completion of the work as stipulated in the special conditions of contract Part (II) and accepted by the bidder shall be deemed to be the essence of the Contract. The contractor shall so organize his resources and perform his work as to complete it not later than the date agreed to. The time for completion of the work contracted for shall be reckoned from the date of Letter of award.

1.17.1 The contractor shall submit the Bar and PERT Charts for work and supply of material along with his offer. Completion Schedule of Individual activity is not binding provided the Transmission Line is completed within the Completion Time.

1.17.2 The contractor shall submit daily progress reports on the proforma specified by PTCUL and also the detailed weekly progress report to the supervising engineer each week.

1.17.3 The contractor shall submit the detailed BAR CHART and PERT NETWORK within the time frame agreed above consisting of adequate number of activities covering various key phases of the work such as design, procurement, manufacturing, shipment and / or field erection activities within fifteen days (15 days) after the signing of Contract. This net work shall also indicate the inter-phase facilities to be provided by the Purchaser and the dates by which such facilities are needed, contractor shall discuss the network so submitted with the Purchaser and the outcome of discussions shall form a part of the Contract to be signed within thirty days from the date of acceptance of notification.

1.17.4 The above BAR CHART and PERT NETWORK shall be reviewed and periodical review report shall be submitted by the contractor as directed by PTCUL.

1.18 RESPONSIBILITY OF THE CONTRACTOR

1.18.0 The contractor shall guarantee and be responsible for the quality and workmanship of all material and complete work, correct designs and drawings and their accuracy, conformity of all work to the approved design and drawings testing of equipment and their correct delivery and/or their erection within the guaranteed completion period.

1.18.1 The purchaser shall have the right to require the contractor to make any change in the design which may be necessary in the opinion of PTCUL, to make the equipment and work conform to the provisions and contents or specification without extra cost to the Purchaser. Approval by PTCUL, or by the representative of the Purchaser of the contractor's drawings, material or of other part of work involved in the contract or of test carried out either by the contractor or by Purchaser, shall not relieve the contractor of any part of the contractor's obligations of meeting all the requirement of the specifications or of the responsibility for the correctness of the contractor's design and drawings. Any manufacture or other work performed prior to the approval of drawing and test will be at contractor's risk.

1.18.2 The contractor shall guarantee and be responsible for the design, fabrication, galvanizing and testing, packing, insurance during transit, dispatch of all material to destination. Proper handling, cartage and storage of all line materials at site in their custody, line erection setting to work of the said transmission line.

1.19 QUANTITY

The quantities mentioned in this specification are purely tentative and can vary to any extent on either side as per site requirements of the purchaser at the unit price mentioned in Price Schedule subject to maximum variation of +20% of total contract value on the higher side .

1.20 PROGRESS REPORT

In addition to the daily progress reports, detailed weekly reports showing the actual progress made in the receipt of materials/equipment by the contractor and completion of various works shall be regularly submitted to purchaser, starting one month from the date of CONTRACT.

1.21 TRAINING TO PURCHASER'S STAFF

The purchaser reserve the right to attach its own staff comprising of engineers and/ or subordinates in the contractor's work or with the erection staff for the purpose of gaining experience, contractor shall extend all necessary facilities for this purpose. However, the contractor shall not incur any expenditure on this account.

7.0 DEVIATION FROM SPECIFICATION

This specification is mainly for the guidance of the manufacturer. These requirements of necessity include some specific elements of construction and material but are not intended to preclude ingenuity of design are improvement. If the bidder proposes any deviation from this specification, these will be considered, provided they are necessary either to improve the utility, performance and efficiency or to ensure overall economy. This will be clearly and explicitly explained in the tender. Such variations are also brought out clause by clause in the prescribed schedule.

7.0 DELIVERY SCHEDULE AND WORK SCHEDULE

The delivery & work shall be quoted specifically and explicitly for each complete item separately.

8.0 DRAWINGS

The contractor shall design & give the following to PTCUL for approval.

) Hardware & Accessories Drawings.

i) Tower Footing Protection Drawings.

Contractor shall supply the material only after approval of drawing and after inspection of authorized representative of PTCUL or after waiver of inspection.
The bidder on the basis of structural drawings shall prepare bill of material and shop drawings at his own and get it approved from PTCUL before fabrication

The contractor shall develop the Tower footing protection drawings and submit to D.G.M. (Engg.) for approval duly recommended by D.G.M.(PI).

9.0 TYPE TESTS / TYPE TEST CHARGES

The offered equipment must have been fully type tested as per relevant ISS and / or any other specified international standards. Photocopy of such type test reports / certificates must be submitted along with the tender bid. Fresh Type Test if required will be paid by PTCUL.

11.0 QUALITY OF WORK

The work executed by Contractor shall be strictly as per electricity safely rules and regulation and in no case shall be inferior in quality of work carried out by various electricity Boards / Corporations in India.

12.0 DEVIATIONS: - The offer should be strict in accordance with the conditions, specifications and other requirements mentioned in the tender specification documents. No deviations are permitted except under special circumstances. If the Bidder wish to depart from specifications in any way, he must draw specific attention to such departure. All such deviations shall specifically be indicted in

the prescribed form submitted along with the tender documents, otherwise it will be presumed that there are no deviations and this interpretation will be binding upon the Bidder. PTCUL is, however, not bound to accept all or any deviations as mentioned in such schedules. Bidder are also advised not to enclose their own standard or printed terms and conditions for sale etc. as the same shall not be considered.

SECTION - 2

TOWERS

1.1 SCOPE

1.1.1 The scope of Bidder covers erection and supply of conductor, insulators, earthwire & tower including (fabrication, galvanization and testing of towers) tower foundations, design, fabrication, testing and supply of all hardware accessories & fittings, dispatch, packing & forwarding, transportation. FOR delivery & unloading at destination stores of all Galvanized stub templates, including bolts, nuts & washers, hangers, D-shackle & all type of tower accessories like phase plate, number plate, danger plate, circuit plate, anti-climbing devices, including tower earthing.

1.1.2 Steel required for 220 KV S/C Transmission line towers shall be procured and used by the Contractor.

1.1.3 All other material such as Zinc for Galvanising, bolts, nuts, washers, D-shackles, hangers, links, danger plates, phase plate, number plate etc required for tower is included in the bidder's scope of supply.

1.1.4 The material to be supplied on FOR Destination Store as covered in this section shall be designed, manufactured and tested as per the requirement specified. The bidder is required to quote ex-work price, Excise Duty, Taxes / Levies, Packing and Forwarding cost, cost of transportation and material from his works/ factory to destination stores.

1.2 STANDARDS

1.2.1 Except where otherwise specified or implied, the design, manufacturing, fabrication, galvanization and testing of towers and tower accessories shall conform to the provisions of IS:802-1995 (Part I, II, III).

1.2.2 The Indian Standard Specification (IS) mentioned below as amended upto date shall be applicable to the materials and process used in the manufacture of towers and tower accessories.

1. IS: 209-1997 Specification for zinc.
2. IS: 269-1989 Portland cement.
3. IS: 278-1978 Specification for Galvanized Steel Barbed Wire for ACD

4.	IS: 3063-1972	Specification for Single Coil Rectangular Section, Washers for Bolts, Nuts & Screws.
5.	IS: 4091-1979	Code of Practice for Design and Construction of Foundations for Transmission Line Towers and Poles.
6.	IS: 4759-1999	Specification for Hot-Dip Zinc Coating on Structural Steel and other Allied Products.
7.	IS: 5358-1969	Specification for Hot Dip Galvanize Coating to Fasteners.
8.	IS: 5613(Part-2/ sec – 1 & 2)	Code of Practice for Design, Installation and Maintenance of Overhead Power Lines.
	Section 1	Design
	Section 2	Installation and Maintenance.
9.	IS: 5613 (Part-3/ Sec – 2) – 1989	Code of Practice for Design, Installation and Maintenance of Overhead Power Lines (Part-III-400 KV lines, Section-2- Installation and maintenance.
10.	IS: 6610-1972	Specification for Heavy Washers for Steel structures.
11.	IS: 6639-1995	Specification for Hexagonal Bolts for Steel structures.
12.	IS: 6745-1998	Speciification for Methods for Determination of Weight of Zinc Coating on Zinc Coated Iron and Steel Articles.
13.	IS: 7215-1974	Speicification for Tolerance for Fabrication of Steel Structures.
14.	IS: 8500-1977	Specification for Weldable Structure Steel (Medium and High Strength quantities).

MATERIAL :

1.2.3 STEEL

Tower member shall be fabricated out of best quality of steel which has been used for the design of members i.e. conforming to IS:226-1975 / IS:2062 or any revision thereof.

The steel shall be procured preferably from reputed Supplier / Producers and will conform to IS:226-1975 / IS:2062 or any other revision thereof. However, up to 8 mm thick structural section can be procured from re-rollers provided.

(ii) Re-rolling of structural steel sections is done from Billets of tested quality

(iii)Re-rolling sections are duly tested as per relevant ISS.

1.3 DETAILS OF TOWER FABRICATION AND WORKMANSHIP:

The tower members shall be fabricated in accordance with IS:802 (Part-II) 1978 or revision thereof. The following important points relevant to fabrication work are described. The Purchaser reserves the right at all times to inspect the fabrication of tower part at the contractor or sub-contractor works

(b) Towers shall have bolted connection. Welding shall not be permitted at any point unless otherwise previously approved by the Purchaser.

(c) The tower members shall accurately fabricated, so that these could be bolted together easily at site without undue strain on the bolts and members.

1.4 GENERAL DESCRIPTION OF THE TOWER:

1.4.1 All the towers to be supplied have been divided into following types:

a) Single circuit A – Type.

b) Single circuit B – Type.

c) Single Circuit C – Type.

1.4.2 The towers are of self-supporting lattice steel type designed to carry the line conductor with necessary insulators, earth wire, and all fittings under all loading conditions.

1.4.3 The tower shall be fully galvanized structure.

1.4.4 Type of towers.

1.4.4.1 The towers are classified as given below:

Type of Tower	Deviation Limit	Typical use
A	0 deg – 2 deg	To be used as tangent tower
B	2 deg – 30 deg	a) Angle tower with tension insulator string
C	30 deg - 60 deg	a) Angle tower with tension insulator string / Dead end tower

Notes: (1) The above towers can also be used for longer span with smaller angle of deviations.

1.5 EXTENSIONS:

1.5.1 The basic towers offered should be so designed that suitable extensions of +/- 0m. 3m, 6m & 9m can be added to their bases without reducing safety factor in any member.

1.5.2 HILL SIDE EXTENSION

Provision for 1.5m & 3.0m, leg extension. attachable to basic tower

1.6 CONFIGURATION AND TYPE OF CONNECTIONS

1.6.1 Bids shall be submitted for vertical towers with single peak, top cross arm, middle and bottom cross arms having equal projection on either side.

1.6.2 All member connections used in the towers, and extensions shall be of bolted type.

1.8 ROAD, POWER LINE, TELECOMMUNICATION LINE AND RAILWAY CROSSING

2.1.1 ROAD CROSSINGS :

At road crossings, the towers shall be fitted with normal double suspension / tension insulator strings as required so that ground clearances at the highest point of the road at maximum temperature in still air is not less than the specified values

2.1.2 POWER LINE CROSSINGS

Where the line has to cross over another line of the same voltage, or lower voltage, suspension type towers with double suspension / tension strings and suitable extensions shall be used. Where long shutdowns are envisaged it would be preferable to undertake power line crossings on suspension towers followed by angle towers suitably guyed, temporarily

2.1.3 TELE-COMMINICATION LINE CROSSINGS

The crossings shall be designed in such a manner that the clearance between conductors of the power line and the telecommunications wires is not less than specified value given in related sub section. For further details, the Contractor shall refer to Code of Practice for Crossings between Power and Tele-communication Lines 1974 copies of which can be had from the General Manager, P&T Deptt. of the concerned office.

2.2 WIND ON INSULATORS

The wind pressure on insulator string shall be calculated in accordance with clause 9.3 of IS code mentioned above.

2.2.1 BASIC SPAN

Basic span of 350 is to be adopted for design of towers.

2.2.2 SAG TENSION

CONDUCTOR AND GROUND WIRE

The sag tension of conductor and ground wire should be done as per clause 10.3 of IS 802-1995 (Part 1 sec 1). The max tension of conductor / Ground wire should not exceed 70% of ultimate tensile strength conductor / Ground wire.

2.3 CONDUCTOR AND GROUND WIRE CONFIGURATION

One number galvanized stranded steel wire shall be used as ground wire for towers. GS wire shall be continuous and shall be provided above conductors at suitable elevation to offer effective shielding and mid span clearances as per specification requirements.

SECTION – 3

SPECIFIC TECHNICAL REQUIREMENTS

1. SCOPE

This section of the specification covers climatic and isoceraunic conditions. Specific technical particulars for towers and accessories for **Diversion work of 14 Km 220 KV S/C Line from RISHIKESH-DHARASU & CHAMBA-DHARASU LINE IN TEHRI DAM Submerged area.**

2. CLIMATIC AND ISOCERAUNIC CONDITIONS

The following data are presented here for indicative purposes only .It shall be the duty of the bidder to verify the same.

MAXIMUM TEMPERATURE (DEG C)

a) Conductor	85
b) Groundwire	53

MINIMUM TEMPERATURE (DEG C) **(-) 5**

i)	Maximum ambient temp.	55
ii)	Mean annual temp.	15

WIND & ICE DETAILS

Wind zone	5
Reliability Level	1
Return Period (years)	50
Terrian Category	2
Radial thickness of ice (mm)	10
Reduction factor for diagonal wind	0.5 (sin ^2 45)=0.5
Reduction factor for combined wind with ice	0.36

RELATIVE HUMIDITY

(i)	Maximum (Percent)	95
(ii)	Minimum (Percent)	10

Average rainfall per annum (mm)	**1500 mm**
a) Rainy months	June to Sept
b) Rainy days in a year	120
Average number of thunder storm days per annum	**50**
Maximum height above mean sea level (m)	**2200 m**
Basic Seismic Coefficients as per IS : 1893	**Zone IV**
Terrain	**light snowy hilly**

3. SYSTEM PARTICULARS

Line Voltage (kv)	220
Highest system voltage (kv)	245
Number of ciruits	2
Frequency (Hz)	50
Neutral	Effectively earthed
Basic Insulation level kV (Peak)	1050
Power frequency withstand voltage (Wet) kV (rms)	460

4. PARTICULARS OF TOWERS FOR 220 KV TRANSMISSION LINE.

Towers

a) Configuration	Single Circuit Vertical type tower
b) Normal span	335 m

4.1 CONDUCTOR AND GROUNDWIRE PARTICULARS

Particulars	Conductor	Ground wire
- Type	Zebra ACSR Conductor	Galvanized standard st. wire 1570 N/mm^2 Sq. mm qlty.
- Normal aluminium area (sq.mm)	420	
- Standing and wire diameter (mm)	54/3.18 Al. 7/3.18 St.	7/3.15
-		
-		
-		
- Total sectional area (mm^2)	484.5	54.55
- Approximate overall diameter(mm)	28.62	9.45
- Approximate mass (kg/M)	1.621	0.426
- Approximate calculated Breaking load (KN)	130.32	81.35
- Modulus of elasticity GN/Sq.mm Kg/Sq.mm	69.0	$19x10^3$
- Coefficient of linear expansion per deg. C	19.3×10^{-6}	11.5×10^{-6}
- Mass of zinc coating Gm/sq.m	260	275
- Configuration of conductor	1 Conductor per phase	
- Location of earth wire	One continuous earth wire to run horizontally above the conductor	

INSULATOR AND INSULATOR STRINGS PARTICULARS:

4.2.1 Suspension insulators shall be used (up to deviations of 5 dag.) on all 'A' type towers and tension insulator strings on all 'B' & 'C' type towers.

19.5.1 Except on approach towers, all suspension strings will consist of 15 insulator discs as per string for 220 KV lines with arcing horns on line side only and tension strings will consist of 16 insulator discs per string for 220 KV lines with arcing horns on both line and tower sides.

19.5.2 Line insulation on approach towers near the sub-station ends up to a length of 1.5 kilometers shall be reduced by providing 14 discs for 220 KV lines in suspension strings at suspension towers and 16 discs for 220 KV lines in tension strings at tension towers, all fitted with arching horns at both ends.

19.5.3 Insulator strings shall be assembled on the ground. Before hoisting, all insulators shall be cleaned in a manner that will not spoil, injure or scratch the glaze of the porcelain but in no case shall any oil be used for this purpose. All accessories shall be properly fitted. It shall be ensured that all current carrying parts are smooth and without dirt, grit, cuts abrasions, projections etc. insulators with hair cracks or chips or those having glazing defects exceeding half centimeter square will not be used.

SECTION - 4

DESIGN OF FOUNDATION

1.0 SCOPE

1.0.0 This section covers the design requirements of plain cement concrete or reinforced cement concrete foundation of self supporting galvanized lattice Towers for **Diversion work of 14 Km 220 KV S/C Line from RISHIKESH-DHARASU & CHAMBA-DHARASU LINE IN TEHRI DAM Submerged area.**

1.0.1 The bidder is required to give guaranteed excavation, concrete (M 20 for RCC, M 15 for PCC), lean concrete (M 10) volumes, weight of reinforcement for different type of foundations as per format given in the schedules.

1.1 CLASSIFICATION OF SOILS

1.1.0 Classification of soils for which foundations are to be designed shall be in accordance with latest edition of IS 1200 (Part-I), IS:5613 (Part, 2/Section 2) and IS : 1498.

1.2 GROUPING AND CLASSIFICATION OF FOUNDATIONS:

1.2.0 Towers for design of foundation shall be grouped as under :

d) Towers with normal height with or without leg extension.

e) Towers with 3m/6m/9m extension with or without leg extension.

f) Special Tower.

1.2.1 The design of foundation shall be based on critical loading in a group and the same shall be adopted for all towers in that group. Only one design of foundation shall be adopted for a particular soil condition.

1.2.2 Depending on the location of water table, the foundations shall be further classified as Dry, Wet as defined in IS:5613 (Part-2/Section-2) and as under

ii) DRY FOUNDATION

Dry Foundation shall be that where sub-soil water is met below the foundation base i.e. below foundation base level.

iii) WET FOUNDATION

Wet Foundation shall be that where sub-soil water rises in the foundation pit upto 1.5 M below ground level: or where there is water over the ground for long periods but does not penetrate beyond 1.0 M below ground such as paddy fields.

iv) SOFT ROCK / FISSURED ROCK

(II) DRY FISSURED ROCK FOUNDATION

The rocks, which can be excavated using normal tools without blasting, are classified as soft rock. These include decomposed rock, hard gravel, and kankar, limestone, late rite or any other soil of similar nature. Under cut type foundation is to be used for fissured rock locations.

(III) HARD ROCK

The locations where chiseling, drilling and blasting is required for excavation, hard rock type foundations are to be used. For these locations rock anchoring is to be provided to resist uplift forces. For design purpose, rock level shall be considered at ground level and no over burden soil weight shall be considered for resisting the uplift.

SECTION -5

1.0 DETAILED SURVEY

On placement of order for erection, the contractor shall make detailed survey of the route of the proposed transmission lines. He will prepare and submit drawings showing proposed structure. These survey maps shall be prepared in the scale of 20 meters equal to 1 Cm. horizontal and 2 meters equal to 1 Cm vertical. At all deviation points the angle shall be marked in degrees. All Kuthca and metalled roads, trees, structures, ponds and other obstructions etc. with in 30 meters on either side of the line route shall be clearly indicate. These maps shall also give the profiles of the route.

Before taking up the detailed survey, the contractor shall submit to the Supervising Owner proposals for the route of the line to be surveyed, which shall be marked on blue prints of graphical sheets. The route of the transmission line shall be fixed in such a way that it is the shortest route and involves the minimum cutting of trees particularly of forest departments. The Supervising Engineer in giving approval to the route will consider the proximity to roads telegraph lines, aerodromes etc. position of Substations and any other considerations as required by him. If at the time of actual survey, the route of the line actually aligned deviates more that 400 meters, substantially altering the approved route, to avoid obstruction from villages, houses, tanks etc. the Contractor shall submit revised proposals for the route of the line and Supervising Engineer shall give his approval to the revised route as early as possible.

On completion of the survey, three blue print copies are to be sent to the Supervising Engineer, and the line shall be constructed exactly in accordance with the approved survey. If any subsequent alternation is found necessary, the Contractor shall submit full details of such alteration and obtain approval of the same from the Supervising Engineer, before carrying out the works. ---- The Contractor shall undertake full responsibility for correct setting of towers and preparation of final Schedules showing the position of towers and type of foundations etc.

The Purchaser will furnish topographical maps prepared by Survey of India since it is restricted area.

1.0.0 Detailed survey, including route alignment, profiling, tower spotting and check survey of this line shall have to be carried out by the Contractor. The Provisional quantity for detailed survey will be indicated in Schedule of Prices. The final quantity for the detailed survey shall be intimated by the site in-charge as per the route length along the approved route alignment. The detailed survey, including profiling, tower optimisation and spotting, shall be carried out by the Contractor on the basis of Tower Spotting Data given by Owner as stipulated herein. The detailed survey shall have to be carried out using GPS, Total work stations, long range scanners and digital

theodolitesof reasonable accuracies which inter-alia include Digitized profiling along the selected route along with plan details and Computer aided tower spotting and optimization using standard software PLS-CADD. Soil-resistivity measurement shall have to be done. The Contractor shall submit digital copies of the data also, including digitized contour maps and/or 3-D wire mesh models of the terrain, profile etc. in a format usable by standard line design software PLSCADD and other software like AUTOCAD.

1.0.1 The Contractor shall submit the proposal for detailed survey based on the preliminary route alignment for approval. The Contractor shall finalise and submit results of detailed survey including any changes suggested within the time schedule as agreed at the time of award. The soil investigation for the obligatory points are to be carried out by the Contractor as detailed out in this specification. The Contractor should note that Owner will not furnish the topographical maps prepared by survey of India but will any assistance that may be required in obtaining the topographical maps. The detailed survey shall be made along the route alignment approved by the Owner, Soil resistivity along the route alignment, shall be measured preferably by a standard make like 'Evershad etc' in dry weather by four electrode method keeping inter-electrode spacing of 50 meters. For calculating soil resistivity formula 2 par (where a=50 metres and r = megger reading in ohms) shall be adopted. Measurement shall be made at each kilometer. along the route of transmission lines. In case soil characteristic, changes within one kms., the value shall also have to be measured at intermediate locations. The megger reading and soil characteristics shall also be indicated in the soil resistivity results,

1.0.2 Route Marking :At the starting point of the commencement of route survey an angle iron spike of 65x65x6mm section and 1000mm long shall be driven firmly into the ground to project only 150 mm above the ground level. The route of the transmission line shall also be recorded using GPS of positional accuracies of 3 m or better, A punch mark on the top section of the angle iron shall be made to indicate location of the survey instrument and the co-ordinates of the location shall also be recordedusing a GPS instrument. Teak wood peg 50 x 50 x 650mm six shall be driven at prominent position at intervals of not more than 750 metre along the transmission line to be surveyed upto the next angle point and the co-ordinates of these points shall also be recorded using a GPS instrument. Nails of 100mm wire length should be fixed on the

top of these pegs to show the location of instrument. The pegs shall be driven firmly into the ground to project 100 mm only above ground level. At angle position stone/concrete pillar with PTCUL marked on them shall be put firmly on the ground for easy identification.

1.0.3 Profile Plotting & Tower Spotting: The complete profiling along the route shall be carried out using modern surveying equipments viz. total stations, GPS, digital theodolite, long rage scanners etc. Reference levels at every 20 m along the route are to be recorded. R/Ls at other undulations along the route as well as in the route plan and other enroute details viz. crossings, building & structures, trees & other infrastructure etc shall also be recorded. Areas along the route, which in the view of the Contractor, are not suitable for tower spotting, shall also be marked. The complete profiling details shall be digitized and the data shall be prepared & stored in the format compatible to computer-aided tower spotting software. A printed/plotted output of the digitized profiling shall be submitted by the Contractor to Employer's site-in-charge for review before taking up computer-aided tower spotting. In addition, hard copies in the standard proforma of the Owner shall also be generated as follows: From the field book entries and the above mentioned digital data, the route plan with enroute details and level profile shall be plotted and prepared to scale of 1:2000 horizontal & 1:200 vertical on 1.0, 10 mm squared paper as per approved procedure. Reference levels at every 20 meters along the profile are also to be indicated on the profile besides, R/Ls at undulations. Areas along the profile Sheet, in the view of the Contractor, are not suitable for tower spotting, shall also be clearly marked on the profile plots. If the difference in levels be too high, the chart may be broken up accordingly to requirement. A 10 mm overlap shall be shown on each following sheet. The chart shall progress from left to right. Sheet shall be 594 mm wide in accordance with the IS standard. For 'as built' profile these shall be in A1 size.

1.0.4 Optimization of tower locations shall be done by the Contractor using computer aided tower spotting software PLSCADD and the Contractor shall furnish sample calculations and manual tower spotting drawings for some typical sections and also of any other sections as and if desired by the Owner at no extra cost to the Owner

1.0.5 Sag Template & Tower Spotting Data: Sag Template Curve drawing and Tower Spotting Data shall be supplied by the Contractor based on approved design and submitted for approval to the Owner Sag template prepared on the basis of

supplied sag-template curve drawing shall ~~only~~ be used for tower spotting on the profiles. Two numbers of the approved template, prepared on rigid transparent plastic sheet, shall be provided by the Contractor to the Owner for the purpose of checking the tower spotting. The templates shall be on the same scale as that of the profile

1.0.6 The Contractor shall submit Four set of drawings of final route survey and profile etc. with necessary details as mentioned in Technical specification for approval of the Dy. General Manger (Engineering) – PTCUL. After scrutiny of the drawings by the Owner and after incorporating all the modifications as mutually agreed the Contractor will submit the final drawings for final approval. The Owner will formally approve the tracing and Contractor will supply two copies of approved drawings.

1.0.7 On the completion of erection work, the Contractor will supply to the Supervising Engineer free of cost, the complete as executed drawings of the line(s) showing each and every structure as actually erected, roads, railway crossing, all major or small river crossing etc. together with measured spans. At all deviation points, the angle shall be marked in degrees. All Kutcha and metal roads, trees structures, ponds and other obstructions etc. within 30 meters on either side of the route shall be clearly indicated. The drawings shall also show telecommunication or power lines within 30 meters on either side of the lines. The drawings shall be drawn in ink of good quality on tracing paper assuming a scale of 20 Mtr. = 1Cm. horizontal and 2 Mtr.=1 Cm vertical.

2.0 PROPERTIES OF EARTH

The following general physical properties of earth under various conditions have been assumed for the design of foundations :

	Normal Dry	Wet earth due to the presence of Sub soil water	Wet earth due to the presence of surface water	Dry Black cotton soil
Effective weight of earth kg/CU Meter	1440	940	1440	1440
Angle of repose of earth in degree	30	15	15	30
Ultimate bearing strength of earth in Kg/Sq. Meter	37350	13675	13675	13675

3.0 TESTING OF SOIL

The contractor shall be required to undertake testing of soil at tower locations and shall submit his report about the sub-soil water table, type of soil encountered, bearing capacity of soil, and possibility of submergence required for the correct casting of foundation. The Contractor shall furnish soil resistivity to the Supervising Engineer alongwith route alignment, map. After soil investigation along the line alignment, the Contractor shall furnish final quantities of foundation types based on the soil investigation carried out and on approval such foundations shall be installed

4.0 SETTING OF STUBS

4.1 The stub shall be set correctly in accordance with approved method at the exact location and alignment and in precisely correct levels. The stub setting templates shall be used for proper setting of stubs. Stubs shall be set in the presence of Purchaser's representative available at site where required and for which adequate and advance intimate shall be given to the Supervising Engineer by the Contractor.

4.2 The foundations are to be made as per designs and drawings approved by the Owner. Extent of the work as defined by such drawings shall not be exceptional cases where the prior approval of Supervising Engineer is to be obtained

Setting of stub at each location shall be approved by the Purchaser's representative. The approval shall not however, absolve the contractor of his responsibility of correct setting of stubs and casting of foundations who will be required to rectify the faulty work at his own expenses.

The Supervising Engineer reserves the right to uncover the foundations subject to a total max. of 25% locations and if any foundation is found faulty, the Contractor shall be required to uncover at all foundations 1.50 Kms on either side of faulty foundation and bear all the expense thereof as well as rectifying all inadequate or faulty foundations thereby disclosed and putting all these back in order

5.0 BACK FILLING AND REMOVAL OF STUB TEMPLATE

5.1 Following opening of form box and removal of shoring and shuttering, if any, back filling shall be started after repairs, if any, to the foundation concrete, back filling shall normally be done with the excavated soil, un less it consists of large boulders which shall be broken to a maximum size of 80 mm

2.0 The back fill material should be clean and free from organic or other foreign materials. The earth shall be deposited in maximum 200 mm layer, leveled and wetted and tamped properly before another layer is deposited. Care shall be taken that the back filling is started from the foundation and of the pits, towards the outer ends. After the pits have been back filled to full depth, the stub template may be removed.

2.1 The back filling and grading shall be carried out to an elevation of about 75mm above the finished ground level to drain out water. After back filling, 150mm high earthen embankment (Bandh) will be made along with sides of excavation pits and sufficient water will be poured in the back filled earth for at least 24 hours

2.2 The stub setting template shall be opened only after completion of back filling

2.3 The back filling of foundations shall be carried out so that after one monsoon the level of back filled earth does not go below the surrounding ground level. However, if any foundation settles below ground level the same shall be filled up by the Contractor to be in level with the surrounding ground without any extra charges to the Corporation

6.0 CURING

The concrete after it is 24/72 hours (as the case may be) old shall be cured by keeping the concrete wet continuously for a period of 10 days after laying. The pit may be back filled with selected earth sprinkled with necessary amount of water and well consolidated in layers not exceeding 200 mm of consolidated thickness after a minimum period of 24/72 (as the case may be) hours and thereafter both the back filled earth and exposed chimney top shall be kept wet for the remainder of the prescribed time of 10 days. The uncovered concrete chimney above the backfilled earth shall be kept wet by providing empty cement bags dipped in water fully wrapped around the concrete chimney for curing and ensuring that the edges are kept wet by frequent pouring of water on them

7.0 EARTHING

The footing resistance of all towers shall be measured by the Contractor in dry weather after their erection before the stringing of earthwire. In case the tower footing resistance exceeds 10 Ohms pipe type earthing/counterpoise earthing where ever required shall be done in accordance with stipulations made in this specifications or as per direction of Supervising Engineer

8.0 PIPE EARTHING

The grounding shall be effected by making about 300mm dia 3750 mm deep pit a distance of not less than 3650 mm away from the stubs and filling in the pit with finely broken coke having the granule size not more than 25mm and salt in such a way that minimum cover of 125 mm thick salt fixed coke shall be maintained from the pipe on all side and that the top edge of the pipe shall be at least 600 mm below the ground line. The G.S. strip shall be buried not less than 600mm deep from the ground level

9.0 COUNTERPOISE EARTHING

Where necessary because of difficulty in grounding pipe in rocks or to control excessive high tower footing resistance, special earthing arrangement shall be employed in the form of counter poise earthing to bring down the tower footing resistance to 10 ohms. The counter poise earth shall be composed, of 7/9 SWG galvanized steel wire having suitable G.S. lug soldered or compressed at its one end, complete with 16mm dia bolts and nuts, required for connecting the earthing to the tower end. The counter poise shall be buried radially away from the tower base at 600 mm below ground level. The length of wire on each leg shall not in any case be less than 30 meters. It can however be increased to bring the resistance below 10 ohms and will be paid at Quoted Rate on Pro Rata basis.

10.0 TOWER ERECTION & INSTALLATION OF LINE MATERIAL

11.1 Tower shall be erected by piecemeal method on the foundations not less than 14 days after concreting and after such time that the concrete has acquired its full strength. The towers shall be erected in the best workmanship, manner and its members shall not be strained or bent during the course of erection.

11.2 Care shall be taken to see that the jointing surface are clean and free from dirt and grit.

11.3 The tower erection shall be done in strict accordance with the approved drawings.

11.4 After initial erection, all tower bolts shall be checked to ascertain that all nuts are fully tight. Suitable means shall be adopted by the Contractor to ensure that none of the nuts have been left out

11.5 The bolts threads shall be punched to avoid the nuts becoming loose. Punching of bolts shall be made by chamfering the threads with centre punch in at atleast three places equally spaced on the contact surface of bolts & nuts.

11.6 The contractor shall be entirely responsible for the correct erection of all towers as per the approved drawings and their correct setting on alignment approved by the Owner.

11.7 If the stubs of super structures after the erection are found of differ from approved drawing or to be out of alignment, the Contractor shall dismantle and re-erect them correctly at his own cost without extensions of time.

11.8 The tower must be truly vertical after erection and no straining will be permitted to bring them in alignment. Tolerance allowed for verticality shall be one degree that 1 on 360 of tower height.

11.0 INSULATOR HOISTING

12.1 Suspension insulators shall be used (upto deviation of 2^0) on all 'A' type towers and tension insulator string on all 'B'&'C' type towers

12.2 Except on approach towers, all suspension strings will consist of 14 insulators discs 9000 kg E & M strength per string for 220 KV S/C lines with arching horns on line side only and tension string of 15 insulators disc per 17250 kg E & M strength per string for Single circuit transmission lines with arching horns on both line and tower side.

12.3 Insulator strings shall be assembled on the ground. These shall be cleaned and examined for hoisting. All accessories shall be properly fitted. It shall be ensured that all current carrying parts are smooth and without dirt, grit, cuts abrasions, projections etc. Insulators with hair cracks chips or those having glazing defects exceeding half centimeter square will not be used.

12.0 STRINGING OF CONDUCTOR & EARTHWIRE.

13.1 The stringing of the conductor and earthwire shall be done in a most standard method used for such lines, which shall be indicated clearly. The Contractor shall give complete details of the stringing method they propose to follow and indicate its adaptability and advantages. They shall also indicate the tools and equipments required for stringing by the methods proposed by them. Contractor shall use his own stringing and erection tools and other equipment.

13.2 Before the commencement of stringing Contractor shall be supplied by the Owner, stringing charts for the conductor and earthwire showing the initial and final sags and tensions for various temperatures and spans, along with equivalent spans. It may be noted that stringing charts for spans where special structures are used may be different as such it may be ensured that proper stringing charts are used as required in the line. The Contractor shall calculate the value of tensions for conductor and earthwire for various equivalent spans of the line at different temperatures, with the help of these charts. The approval of the Supervising Engineer shall be obtained for the values of tension so calculated

13.3 The contractor shall be entirely responsible for any damage to towers or the conductor during stringing. The damaged item shall be replaced without extra charges to the Corporation. The delays so occurred shall be to the contractor's account. He shall also be responsible for proper distributions of the conductor drum to keep the number of lengths of cut pieces of the conductor to a minimum.

13.0 HANDLING OF CONDUCTOR

The contractor shall be entirely responsible for the proper handling of the conductor, earthwire and accessories in the field. Handling and transporting of the conductor and accessories shall be carried out in such a manner as to minimize the possibilities of damages from abrasion through rough handling or dir and grit, getting into the reel of the conductor by touching or rubbing against ground or objects, causing injury to the conductor etc. Particular care shall be taken at all times to ensure that the conductor do not become chinked twisted or abraded in any manner. If the conductor is damaged, the section affected shall be replaced or repaired by putting joint or using repair sleeves or

polishing with emery cloth, so as to give satisfactory performance. At all stages of construction proper care shall be taken so that the conductor surface is smooth enough to give satisfactory corona and radio interference performance. All equipments used in handling or transporting the conductor such as grips, pulley slings, cable care etc. shall be so designed and maintained that the surface which may contact the conductor are kept free.

14.0 PULLING ON OPERATION

15.1 The earthwire shall be strung and securely clamped to the towers before the conductors are drawn up in the order of the top conductors first, then the middle and bottom conductors at the end. It shall be ensured that all the conductors of one section should have identical tension time history.

15.2 The pulling of the conductor into the traveler comprising of aerial and ground rollers shall be carried out in such a manner that the conductor is not damaged or contaminated with any foreign substance and that it may not be rubbed with the rough ground surface, or it damages the standing crops. For this the height of ground rollers shall be fixed in such a manner that the conductor/earth wire does not touch the standing crops and damage them or gets damaged by touching. The travelers shall have size and shapes most suitable and as recommended by the conductor manufacturer. These shall be approved by the Supervising Engineer, before use. The traveler surface in contact with aluminium surface of conductor shall be of such a material that conductor is not damaged e.g. neoprene rubber of stainless steel. These shall be equipped with high quality ball or roller bearing for minimum friction. They should be inspected daily for free and easy movement blocks during stringing and sagging.

15.3 During pulling out operation the tension in each conductor and earthwire shall not exceed the design working tension of the conductor at the actual prevailing temperature. After being pulled the conductor and earthwire shall not be allowed to hang in the stringing blocks for more than 96 hours after being pulled to be specified sag. During the time the conductor and earthwire on the stringing block before sagging in, it shall be ensured that the conductors and earthwire are not damaged due to clashing vibration or other causes.

15.0 SAGGING IN OPERATION

16.1 The conductor and earthwire shall be sagged in accordance with the approved stringing charts before they are finally attached to the towers through the earth wire clamps for earth wire and insulator strings for the conductor.

16.2 The conductor shall be pulled up to desired sag and left in travels for at least one hour after which the sag shall be rechecked and adjusted, if necessary, before transferring the conductor from the clampes within 36 hours of sagging. The adjustment in sag for creep age of conductor should also be made before finally clamping.

16.3 The sag will be checked in the first and last span of the section in case of sections up to eight spans and in one intermediate span also for section with more than eight spans. The Contractor shall be responsible for any damage caused to the towers or to the conductors through over stressing during stringing Dynamometers shall be used in checking the tension in the conductors and earthwire and these instruments shall be periodically checked with a standard dynamometer. The sags shall also be checked from aerial blocks to the insulator clamps.

16.4 The stringing blocks, when suspended on the transmission structure for sagging, shall be so adjusted that the conductor on the traveler will be at the same height as the suspension clamp to which it is secured.

16.5 At sharp vertical angles the sags and tensions shall be checked on both sides of angle. The conductor and earthwire shall be checked on the travelers for equality of tension on both sides. The suspension insulator assemblies will normally assume vertical positions, when the conductor is clamped. Sagging operations shall not be carried out under wind, extremely low temperature or other adverse weather conditions which prevent satisfactory sagging.

16.0 CONDUCTOR DAMAGE AND REPAIR

If the conductor is damaged for whatsoever reason and the damage is not repaired by repair sleeves or emery cloth, the same shall be brought to the notice of the Supervising Engineer, and shall not be used without his approval. Repairing of conductor surface shall be done only in case of minor damages, scuff marks etc. which are safe from both electrical and mechanical point of view. The final conductor surface shall be clean, smooth, without any projections, sharp points, cuts or abrasions etc. for giving satisfactory corona and R. I. performance.

17.0 JOINTING

17.1 All the joints on the conductor or the earth wire shall be of compression type in accordance with the recommendations of the manufacturers, for which the necessary tools and equipments like, compressor and dies, grease gums presses etc. shall have to be arranged by the contractor. These joints will be made in the best workmanship like manner, shall be perfectly straight and having maximum strength. Each part of the joints shall be cleaned by wire brush to make it free of rust or dirt etc. and properly greased before the final compression is done with the compressors.

17.2 All joints or splices shall be made at least 30 meters from structures. No joints or splices shall be made in spans crossing over main roads, railways, small rivers or in tension spans. Not more than one joint shall be allowed in one span. The compression type fittings used shall be of the self centering type or care shall be taken to mark the conductor to indicate when the fitting is centered properly. During compression or slicing operation the conductor shall be handled in such a manner as to prevent lateral or vertical bearing against dies. Care shall be taken to protect the conductor from

scratches, abrasions or other damages. After pressing the joint the aluminum sleeve shall have all corners rounded, burrs and sharp edges removed and smoothened.

18.0 CONDUCTOR & EARTHWIRE ACCESSORIES

18.1 Accessories like, vibration dampers, armour rods, etc. for the conductor shall also be fitted on the line as desired by the Owner / Supervising Engineer. Armour rods shall be provided at all suspension supports of the conductor and vibration dampers will be provided at both ends of each span at suitable distances from the supporting points for each conductor and earth wire for 220 KV Single Circuit lines. While fixing these on the line, care must be taken that conductor is not damaged in any way and no sharp edges are left at any point. All accessories shall be clean smooth and in prefect condition before lifting

18.2 Fasteners in all fitting and accessories shall be secured in position

19.0 FINAL CHECKING, TESTING & COMMISSIONING

19.1 After completion of the works, final checking of the line shall be done by the Contractor to ensure that all the foundation work, tower erection and stringing have been strictly according to the specifications given herein and before as approved by the Owner / Supervising Engineer. All the works shall be thoroughly inspected keeping in view the following main points:

a) Sufficient backfilled earth is lying over each foundation pit and it is adequately compacted.

b) Concrete chimneys and their copings are in good and finally shaped conditions.

c) All the tower members are correctly used strictly according to finally approved drawings and are free of any defect or damage, whatsoever.

d) All the bolts are fully tightened and they are properly punched.

e) The stringing of the conductor and earth wire has been done as per the approved sag tensions charts and desired clearances are available.

f) No damage, minor or major, to the conductor, earth wire accessories and insulator strings, still un-attended are noticed.

19.2 The contractor shall submit a report to the Supervising Engineer of points mentioned in 3.25.1.

19.3 After final checking the line shall be tested for insulation in accordance with tests prescribed by the Supervising Engineer. All arrangements for such testing or any other test desired by the Supervising Engineer, shall be done by the Contractor and labour, transport and equipment shall be provided. Any defects found out as a result of such tests, shall be rectified by the Contractor forth with without any extra charges to the Purchaser.

19.4 In addition to the above, the Contractor shall be responsible for testing the total and relative sags of the conductors and earth wire are with the specified tolerance. Such tests shall be carried out at selected points along the route as required by the Supervising Engineer and the Contractor shall provide all necessary equipment and labour to enable the tests to be carried out.

1.0 After satisfactory tests on the line and on approval by the Supervising Engineer, the line shall be energized at full operating voltage before taking over by Purchaser.

1.0 TECHNICAL SPECIFICATION FOR 220 KV S/C HARDWARE FITTINGS

1.1 The 220 KV S/C hardware fittings shall be suitable for three phase 50 cycles/sec. effectively earthed system in moderately polluted atmosphere and for operation at voltage 10% higher than the respective rated service voltages. The edges lips etc. of all the hardware components shall be so rounded as to reduce corona loss complete with all components which are necessary or usually used for their efficient performance and satisfactory maintenance.

1.2 The hardware fittings for 220 KV S/C lines shall be suitable for ACSR Zebra conductor and 7/9 SWG earth wire respectively line data for different lines are detailed below :

A. SYSTEM VOLTAGE: 220 KV

B. CONDUCTOR

a)	Code Name	Zebra
b)	Total sectional area mm^2	484.5
c)	Number/dia of strands:	
i)	Aluminium (mm)	54/3.18
ii)	Steel (mm)	7/3.18
d)	Overall diameter (mm)	28.62
e)	DC resistance at 20^0 C	0.06868

f)	Approximate calculated bearing Load (KN)	130.32

C. DISC INSULATOR

I – Single Suspension String

i)	Size of insulator	255x145
ii)	E&M Strength (KN)	90
iii)	Ball & Socket (mm) (As per IS2486 Part-II)	16
iii)	No. of disc in a string	15 Units

II – Tension String (For Both Single & Double)

i)	Size of insulator	280x170
ii)	E&M Strength (KN)	160
iii)	Ball & Socket (mm) (As per IS2486 Part-II)	20 mm
iv)	No of disc in a string	16 Units

D. – NO. OF CONDUCTOR PER PHASE One

1.3 QUALITY

The quality of hardware fitting surface finish and workmanship shall be of high grade which is suitable and customary for High tension lines.

1.4 MARKING

Each component part of the fittings shall be legible and inselibly marked with PTCUL alongwith the trade mark of the manufacturer and other details as specified in the relevant standard specifications applicable in that behalf. In aluminium sleeves etc. the portion of which is not to be compressed, the punching 'NOT TO BE COMPRESSED' should be done in this area, prominently marked by ruling indications.

1.5 MATERIALS

1.5.1 All the component parts of the hardware fittings except the clamps, security clip and split pins shall be made of forged steel/malleable iron and shall be hot dip galvanized after all machining except female threads which shall be cut after galvanizing and shall be protected from rust by means of greasing.

1.5.2 The suspension clamps shall be high strength aluminum alloy.

1.5.3 The security clips for use with ball and socket coupling and split pins for use with bolts shall be made of suitable material of stainless steel or phosphorus bronze. The security clips shall be provided positively for locking the coupling. The legs of the security clips shall be spread after installation to prevent complete withdrawal from the from the socket.

1.5.4 The hardware shall meet requirement of latest edition of the IS 2486 (Part I, II& III) 1971 Zinc coating shall satisfy the requirement of latest edition of the IS 2033 1972.

1.5.5 All bolts, nuts and screw threads shall as far as possible be of with worth thread throughout. All bolts heads and nuts shall be hexagonal and their required nuts shall be locked in approved manner. All bolts and nuts shall be hot dip galvanized including the threaded portion of the bolts with the exception of threads of nuts and in tapped holes, which shall be cut after galvanizing and shall be protected from rust by means of greasing. It should conform to BSS No. 916 & 729.

1.6 SINGLE SUSPENSION FITTING SUITABLE FOR ZEBRA CONDUCTOR

1.6.1 The suspension fittings suitable for Zebra conductor shall be free centre type and shall consist of following components :

(a) BALL HOOK

It shall be made of hot dip galvanized (HDC) forged steel and shall be suitable for attaching to 'V' hanger of 20mm M.S. round. The diameter of the 'Ball shall be 16mm.

(b) HORN HOLDER SOCKED EYE

It shall be made of HDG malleable cast iron or forged steel having provision for fixing arcing horn with the help of the separate nuts, bolts and spring washers.

(c) LINE SIDE ARCHING HORN

The spark gap of the arcing horn shall be of fixed type for the spark gap. The spark gap should be spaced so as to ensure effective operation under actual conditions. Arcing horn should be fitted with socket eye with the separate bolts having nuts and spring washers. The type of arcing horns to be used in suspension fittings for Zebra conductor shall be as follows.

(i) Suitable for Zebra conductor.
(ii) It shall be ball ended rod type made of HDG M.S. Round.

(d) SUSPENSION CLAMPS

It shall be made of FREE CENTRE TYPE OF 'SALVI' design only and made of Aluminum Alloy as per IS 2486. the suspension clamps of turnion type, Envelop type or any other design are not acceptable. The FREE CENTRE type suspension clamps shall have free movement strictly along the axis of the conductor and not below or above the axis of the conductor. The suspension clamps shall have Ball mouth and shall be Sharp end curved downwards in such a manner, so as to keep the conductor in its catenary shape. The suspension clamps shall be suitable for holding Zebra conductor complete with performed armour rods Suitable for Zebra conductor.

It shall be of free centre type suitable for Zebra conductor complete with 12 No. performed armour rods of 7.87mm dia each overall diameter of conductor with armour rods will be approx. 33.7mm.

All the SIX suspension clamps shall permit the respective conductor to slip before failure of conductor occurs and should have a slippage strength not less than 25% of breaking load of conductor i.e. 22.42 KN (Zebra)

1.6.2 The attachments of suspension clamps to socket eye should be through a threaded and bolt, complete with spring washers nut and split pin.

1.6.3 The individual components i.e. ball hook, socket eye and suspension clamp as well as complete set shall have 7000 kg mechanical strength without any distinct deformation.

1.7 SINGLE TENSION FITTING SUITABLE FOR ZEBRA CONDUCTOR

1.7.1 The single tension fittings suitable for Zebra conductor shall be of compression type and shall consist of following components.

(a) **Anchor Shackle** : It should be made of HDG forged steel. The bolts of the anchor shackle shall be threaded and shall be complete with spring washer nut and split pin.

(b) **Horn Holder Ball Link** : It should be made of HDG forged steel and shall have position of fixing tower arching horn with the help of two separate bolts having nuts and spring washers.

(c) **Arcing Horn** : The spark gap of the arcing horn shall be of fixed type for the spark gap. The spark gap should be spaced as to ensure effective operation under actual conditions. Arcing horn should be fitted with horn holder ball link and socket clevis with the separate bolts having nuts and spring washers. The tower side and line side arcing horns should be of following types:

(i) **Tower side arcing horn** : It shall be of ball ended rod type and made of HDG M.S. Round

(ii) **Line side arcing horn** : The line side arcing horns to be used in tension fittings for Zebra conductor shall be as follows :

Suitable for Zebra conductor: It should ball ended rod type HDG M.S. Round.

(d) **Horn holder socket clevis**: it shall be made of HDG malleable cast iron/forged steel and shall have provision of fixing line side arcing horn with the help of two separate bolts having nuts and spring washers.

(e) Compression type Dead end clamp complete with jumper terminal suitable for Zebra conductor.

1.7.2 The tension clamp shall be of compression type and their slipping strength shall not be less than 95% of the breaking load of conductors. However, it should develop the strength of the conductor. The outer sleeve of the clamps shall be made of extruded aluminum pipe. The aluminum filler plug shall also be provided. The same material as that of aluminum sleeves and shall have provision for fixing jumpers plate with jumper terminal with three separate bolts complete with nuts and spring washer. The jumper plate of the whole periphery of the clamp as per drawing annexed with. The shape of cross section of sleeves shall be round before, compression and shall be hexagonal after compression.

1.7.3 The attachment of tension clamps to socket clevis should be through a threaded and bolts complete with spring washers nut and split pins. The slipping strength of the clamps with respect of conductor shall not be less than 95% of the breaking strength of the respective conductor i.e. 85.19%.

1.7.4 The individual components i.e. anchor shackle, Horn holder Ball link and socket clevis, shall have 160 KN mechanical strength without any distinct deformation.

1.8 DOUBLE SUSPENSION FITTING SUITABLE FOR ZEBRA

Double suspension fittings suitable for Zebra conductor shall be free Centre type and shall consist of following components:

(a) ANCHOR SHACKLE (TWO NO.)

It shall be made of hot dip galvanized forged steel and shall be suitable for attaching Lo 'V' hanger of 20 mm M.S. Round.

(b) YOKE (two No.)

It shall be made of HDG mild steel having provision for fixing arcing horn with the help of two separate nuts bolts and spring washers.

(c) BALL CLEVIS: (2 Nos.)

Ball clevis shall be made of forged steel and shall be not dip galvanized.

(d) **ARCING HORN FOR ZEBRA** (Tower side arcing horn)

It shall be ball ended rod type made of HDG M.S. Round of 16 mm dia. The spark gap of the arcing horn shall be of fixed type. Spark gap should be so spaced as to ensure effective operation under actual working condition. Each arc of arcing horn should be fitted with Yoke plate with two separate bolts having nuts and spring washers.

(e) SOCKET CLEVIS (2 No.)

It shall be made of malleable iron (Hot dip galvanized.)

(f) LINE SIDE ARCING HORN

It shall be made of 16 mm dia M.S. rod in case of Zebra and shall be pipe type made of mild steel tube of 27 mm dia in and shall be fitted with yoke plate (bottom) with two separate bolts having nuts and spring washer.

1.9 DOUBLE TENSION FITTING SUITABLE FOR ZEBRA

Double tension fittings suitable for Zebra conductor shall be of compression type and shall consist of following components :

(a) ANCHOR SHACKLE (TWO NO.)

It shall be made of hot dip galvanized forged steel. The bolts of anchor shackle shall have threaded end and shall be complete with spring washer nut and split pins.

(b) CHAIN LINK

It shall be made of hot dip galvanized forged steel attaching anchor shackle

(c) YOKE PLATE (2 No.)

It shall be made of mild steel hot dip galvanized.

(d) BALL CLEVIS

It shall be made of forged steel hot dip galvanized.

(e) SOCKET CLEVIS
It shall be made of malleable iron without hot dip galvanized.

(f) ARCING HORN (LINE SIDE)
It shall be made of pipe type made of M.S. pipe (HDG) with suitable fixing arrangements to the yoke.

(g) ARCING HORN (TOWER SIDE)

It shall be made of M.S. round ball ended type (HDG). The spark gap of the arcing horn should be so spaced as to ensure effective operation under actual working conditions.

(h) CLEVIS EYE

Forged steel (HDG) for attaching dead end clamp with yoke plates.

1.10 COMPRESSION DEAD END CLAMP COMPLETE WITH JUMPER TERMINAL SUITABLE FOR ZEBRACONDUCTOR.

Tension clamp shall be of compression type and their slipping strength shall not be less than 95% of the breaking load of conductor. However, it should develop strength of conductor.

The outer sleeves of clamp shall be made of extruded aluminum. The sleeves shall be made of HDG forged steel. Aluminum filter plus shall also be provided. The jumper plate and jumper terminal shall be made of same material as that of aluminum sleeve and shall have provision for fixing jumper plate with jumper terminal with three separate bolts complete with nuts and spring washer. The jumper plate for whole periphery of the clamp as per drawing annexed with. The shape of cross section of sleeves shall be round before, compression and shall be hexagonal after compression.

1.10.1 The attachment of tension clamp to socket clevis should be through a threaded and bolt complete with spring washer, nuts and split pin.

1.10.2 The individual component i.e. anchor shackle, ball link and socket clevis shall have mechanical strength of 11500 kg for Zebra conductor without any distinct deformation.

1.10.3 Slipping strength of the clamps with respect to a conductor shall not be less than 95% of breaking strength of conductor which is 11500 kg in case of Zebra conductor.

THE MINIMUM TECHNICAL PARTICULARS OF INSULATOR STRING HARDWARE SHALL BE AS FOLLOWS:

1. SUSPENSION CLAMP

a)	Type	Free centre type suitable for respective conductor.
b)	Material alloy	High strength corrosion resistance aluminium
c)	Manufacturing process	Gravity die casting.
d)	Slip strength	Not less than 25% of breaking load of conductor.
e)	Single suspension	90 KN
f)	Size of ball & socket	16 mm B&S designed.

2. TENSION CLAMP

(a)	Type	Compression. 160 KN
(b)	Material	
	(i) Outer Sleeve	Aluminum tube formed by Extrusion process.
	(ii) Inner Sleeve	Forged steel
(c)	Minimum failing load	95% of the breaking load of conductor

(d) Size of ball & socket 20mm B & S designed.

1.11 TESTS ON HARDWARE FITTINGS

1.11.1 The hardware fittings shall be subjected to the following tests in accordance with IS:2486 *Part-I) 1977 or any latest amendment thereof.

1.11.1.1 TYPE TEST

a) Slip strength test for suspension clamps — as per clause 5.4.1 of IS 2486 Part-I-1971 (The test shall be carried out with the performed armour rods)

b) Slip strength test for Tension fittings — as per clause 5.4.3 of IS 2486 Part-I-1971.

c) Mechanical test for the suspension and tension fittings / each component except dead end clamp

The complete fittings shall be subject to a load equal to 50% of specified mechanical failing load and increased at a steady rate until the specified mechanical failing load is reached. The load shall be held for one minute. After removal of load the fitting should not allow any distinct deformation and it should be possible to reassemble the components by hand or small hand tools made be used to remove cotter keys and loosen the nuts initially. After the completion of above test the applied load should be increased until failing load is reached and the value recorded. The individual component except dead end clamp shall also be tested in above manner.

d) Electrical resistance test tension clamp only) — As per Clause 5.6 of IS-2486 (for (Part – I)1971

e) Heating cycle test (for tension clamps only — As per clause 5.7 of IS 2486 (Part – I) 1971

f) Verification of dimensions — As per clause 5.8of IS 2486 (Part-I) 1971

2.0 TECHNICAL SPECIFICATION OF EARTH WIRE/ HARDWARE FITTING

2.1 SUSPENSION CLAMPS (Sealed type)

2.1.1 Suitable suspension clamps as per specification drawing shall be used to support the earth wire at all suspension towers. The clamps shall conform to IS 2486 1971 and shall give adequate area of support to the earth wire. The

grooves of the clamps shall be smooth finished in uniform circular or oval shape and shall elope downwards in a smooth curve to avoid edge support the earth wire. There shall be no sharp points in the clamps coming in contact with the earth wire. There shall not be any displacement in the configuration of the earth wire strands nor there unduly stress final assembly.

2.1.2 Sealed type clamps shall comprise the following assembly parts :

i) Bracket : (Bracket shall have 10mm minimum thick square plate having 4 No. 17.5 mm diameter holes squarely placed.
ii) Clamp
iii) Pin
iv) U Bolts

2.1.3 The clamping piece and the clamp body shall be clamped at least by two U bolts of size not less than 10 mm diameter having one nut and one 3 mm lock washer on each of its line.

2.1.4 The clamp may be made of either forged steel/die cast steel or malleable cast iron. In case o MCI, the clamp shall be free from all internal defects like shrinkage, blow holes etc. and quality of the product shall be uniform throughout.

2.1.5 The complete assembly shall be guaranteed from slip strength of not less than 1750 kg. the ultimate tensile strength of the assembly shall be at least 9000 Kg.

2.2 SUSPENSION CLAMP (FREE CENTRE TYPE)

2.2.1 At all suspension towers suitable suspension clamps shall be used to support the earth wire. The suspension clamps hang from U bolt which is fixed vertically downwards in the ground wire post of suspension towers. The U bolts are fixed in the direction of the run of line. This U bolt is part of tower.

2.2.2 Necessary arrangements for hanging the suspension clamps from U Bolt shall be supplied along with the suspension clamp and shall be considered a part of clamp.

2.2.3 The clamps shall conform to general requirement of IS 2486 (Part-I) 1971 or latest amendment thereof.

2.2.4 The suspension clamps (Complete assembly) shall consist of the following components.

(i) Suspension Clamps (Detailed dimensions be furnished)
(ii) Keeper piece.
(iii) U – Bolt & nuts.
(iv) Anchor shackle to be used for suspension the suspension clamps from U-Bolt of earth wire peak to tower.
(v) Nuts bolts, washers and split pin etc.

2.2.5 The clamping piece and the clamp body shall be clamped at least two U-bolts of size not less than M-10 dia having one nut one washer 3.5mm thick spring lock washer on each of its limb. Suspension clamps shall be provided with inverted type U-bolts. Each limb of one of the U-bolts shall be long enough to accommodate the leg of the flexible copper bond.

2.2.6 Tower length of suspension clamps suitable between tower peak and area of earth wire of clamp (including one 65mm long U bolt which is already fixed in tower peak) shall be 200mm.

2.2.7 The material for the suspension clamps shall be such that it gives the required mechanical strength with specified dimension. The clamps may be made either for forged steel (as per IS 2104) or malleable cast iron (as per IS 2107 and IS 2108) but in case the latter the clamps shall be free from all internal defects like shrinkage inclusion blow holes etc. and the quality of the product shall be uniform through out. All forging and castings shall be of good finish and free from defects. The casting shall be free from defects. The casting shall free from internal defects like shrinkage, inclusion blow holes etc. There shall be no sharp points in the clamps coming in contact with the earth wire.

2.2.8 All the ferrous parts of complete assembly including bolts, nuts and lock washers shall be hot dip galvanized as per IS 2633 / 1972. Spring washers may be electro-galvanized. The female thread of nuts may be greased only.

2.2.9 The assembly shall give adequate area of support to the earth wire. The groove of the clamps shall be smooth curve in 25 mm length at either end to avoid sharp support for the earthwire and to reduce the intensity of bending moment at the clamp edge, due to vertical load. There shall not be any displacement in the configuration of the earth wire strands nor shall they be unduly stressed in final assembly.

2.2.10 The suspension assembly shall be guaranteed for the following values:

1. Slip strength Not less than 25% of breaking load of earth wire.
2. Minimum failing load Not less than breaking load of earth wire.

2.2.11 TESTS

The suspension clamps shall be subjected to the following tests including the method of testing as per IS 2489 (Part I) 1971.

(a) Type Test

i) Visual examination As per clause 5.10 of IS 2486 (Part-I) 1971
ii) Verification of dimension As per clause 5.8 -do-
iii) Slip strength test As per clause 5.4 -do-
iv) Minimum failing load As per clause 5.11 -do-
v) Galvanizing Test As per clause IS 2633 1972 with latest revision

(b) Acceptance Test

i) All the tests as above
ii) Megnaflex test As per IS 3703 1980

(c) Routine Test

i) Visual examination As per clause 5.10 of IS 2486 (Part-I) 1971
ii) Verification of dimension As per clause 5.8 -do-
iii) Routine mechanical Test As per clause 5.11 of -do-
iv) Megnaflex test As per IS 3703 1980

2.3 TENSION CLAMPS

2.3.1 At all the tension towers suitable compression type tension clamps shall be used to hold 7/9 SWG 915 gm quality galvanized steel earth wire.

2.3.1.1 The tension assembly shall consist of the following components

i) Compression tube and Dead end tub
ii) Jumper tube
iii) Anchor Shackle
iv) Rivet, Washers and split pin etc.

The compression tube & jumper tube shall give adequate area of support without any slip to the earth wire under normal working tension and vibration conditions.

2.3.2 The dead end tubes and jumper tubes of tension clamps shall be made of forged steel conforming to relevant ISS.

2.3.3 All forging shall be of good finish and free from all defects. There shall be no sharp points in the tub coming in contact with the earth wire. There shall also not be any displacement in the configuration of the earth wire strands nor shall they be unduly stressed ion the final assembly. The tube shall also give smooth surface, after compression. The complete assembly shall be so designed so as to avoid un due handling in any part of assembly and shall not produce any intensity of bending moment of the clamp in horizontal or vertical directions.

2.3.4 Suitable lugs for jumper connection shall also be supplied along with necessary bolts & nuts.

2.3.5 All ferrous parts of complete assembly including bolts, nuts and washers shall be hot dip galvanized as per IS 2633. Spring washers may be Electro-galvanized. The female threads of the nuts may also be oiled only.

2.3.6 The assembly shall be connected to 22/00.5 dia hole in 8 mm thick horizontal strain plates of the lower body by means of D shackle and or eye link.

2.3.7 The jumper terminal plate shall be welded with dead end at an angle of 30^0C from the vertical plane. The jumper shall pass in a vertical plane.

2.3.8 The assembly shall be supplied complete with dead end jumper tube anchor D shackles bolts, nuts and washers.

2.3.9 Before and after indicative values of dimension of tube shall be as follows: for 7/9 SWG earth wire.

	Before Compression	After Compression
Internal dia (mm)	10.3 ± 0.3	
External dia(mm)	18.0 ± 0.5	18.0 ± 0.5 mm (Corner to corner)
		15.1 ± 0.5mm (flat to flat)

2.3.10 The slip strength of the assembly shall not be less than 95% of the ultimate strength of the earth wire. The ultimate strengths of clamps shall not be less than that of earth wire. The method of testing shall conform to IS 2486 (Part-I) 1971 or an equivalent standard amended upto date.

2.4 TESTS

The tension clamps will be subject to the following tests including the method of testing as IS 2486 (Part-I) 1971.

(A) Type Test

i)	Visual examination	As per clause 5.10 of IS 2486 (Part-I) 1971	
ii)	Verification of dimension	As per clause 5.8	-do-
iii)	Slip strength test	As per clause 5.4.3	-do-
iv)	Ultimate breaking str.	As per clause 5.5.3	-do-
1.1 Galvanizing Test		IS6745/72 & IS 1573/70	

TECHNICAL PARTICULARS OF DISC INSULATOR UNITS

Sr. No	Description	Unit	90KN	160KN
1.	Weight of single disc	Kg.	7 Kg As per Make	**8 Kg**
2.	Size and Designation of pin ball shank	mm	16	20
3.	Diameter of disc	mm	255	280
4.	Tolerance on Diameter	mm	±11	±13
7.	Ball to ball spacing between Disc	mm	145	170
8.	Tolerance on spacing	mm	±4	±4
9.	Minimum nominal creepage distance of single disc	mm	320	330
10	Tolerance on creepage distance	mm	+ 15	+15
11.	Electromechanical strength of disc	KN	90	160
12.	Power frequency flashover voltage of single disc			
	(a) dry	kV(rms)	80	80
	(b) wet	kV(rms)	50	50
13.	Power frequency withstand voltage of single disc			
	(a) dry	KV(rms)	75	75
	(b) wet	KV(rms)	45	45
14.	Power frequency puncture voltage of single disc	kV(rms)	120	125
15.	Impulse flashover voltage of single disc (dry)			
	(a) Positive	KV(peak)	125	127
	(b) Negative	KN(peak)	130	130
16.	Impulse withstand voltage of single disc (dry)			
	(a) Positive	KV(peak)	120	122
	(b) Negative	KN(peak)	120	122
17.	Visible discharge test of single disc (dry)	KV(rms)	18	18
18.	Maximum RIV at 1MHz and 10kV AC (rms) voltage of single disc	Micro volts	50	50
19.	Purity of zinc used for galvanizing	%	99.95	99.95

TECHNICAL PARTICULARS OF ZEBRA CONDUCTOR & EARTHWIRE 7/9 SWG

Sr. No	Description	Conductor	*Earth wire*
1.	Type	ACSR ZEBRA Conductor	Galvanized Steel
2.	Standard and wire diameter a) Aluminium (mm) b) Steel (mm)	 54/3.18 7/3.18	 7/3.15
3.	Total Sectional a) area (Sq mm)	 484.5	 54.55
4.	Approximate overall diameter (mm)	28.62	10.98
5.	Approximate mass (Kg/Km)	1621	583
6.	Calculate DC resistance at 20^0 C (Max) (ohm/km)	.06868	2.5
7.	Approximate calculated (Kn) breaking load	130.32	68.4
8.	Modulus of elasticity (kg/mm^2)	7034	19369
9.	Co-efficient of linear expansion / ^0C	19.30×10^{-6}	11.5×10^{-6}
10.	Mass of zinc coating gm/sqm	260	240
11.	Configuration of Conductor S/C Line	 Vertical on each side of tower	
12	Location of earhwire	One continuous earth wire .	

SCHEDULE – A1
Bidder's Name

Specification No. ……..

GUARANTEED PARTICULARS OF 7 / 3.15 mm EARTHWIRE

Sr. No	Description	Unit	Particulars
1.	Name & address of manufacturer		
2.	PARTICULARS OF RAW MATERIALS		
2.1	Steel Wires / Rods		
	(a) Carbon	%	
	(b) Manganese	%	
	(c) Phosphorous	%	
	(d) Sulphur	%	
	(e) Silicon	%	
2.2	Zinc		
	(a) Minimum Purity of zinc	%	
3.	STEEL STRANDS AFTER STRANDING		
3.1	Diameter		
	(a) Nominal	mm	
	(b) Maximum	mm	
	(c) Minimum	mm	
3.2	Minimum Breaking load of strand	KN	
3.3	Galvanizing		
	(a) Minimum weight of zinc coating per sqm. of uncoated wire surface	gm	
	(b) Minimum number of one minute dips that the galvanized strand can withstand in the standard piece test	Nos.	
	(c) Min. No. of twists in a guage length equal to 100 times dia of wire which the strand can withstand in the torsion test	Nos.	

PAGE – 2
SCHEDULE – A1
Bidder's Name

Specification No. ……

Sr. No	Description	Unit	Particulars
4.	STRANDED EARTHWIRE		
4.1	UTS of earth wire	KN	
4.2	Lay length of outer steel layer	mm	
4.3	DC resistance of earth wire at 20^{o} C	Ohm / KN	
4.4	Standard length of earth wire	M	
4.5	Tolerance on standard length of earth wire	±m	
4.6	Direction of lay for outside layer		
4.7	Linear mass of the earth wire		
	(a) Standard	Kg / km	
	(b) Minimum	Kg / km	
	(c) Maximum	Kg / km	
5.	Drum is as per specification		

Date
Place

(Signature)

(Printed Name)
(Designation)
(Common Seal)

SCHEDULE – B1
Bidder's Name
……..
Specification No. ……..….

GUARANTEED TECHNICAL PARTICULARS OF SUSPENSION HARDWARE FITTINGS (SUITABLE FOR ACSR 'ZEBRA' CONDUCTOR)

Sr. No	Description	Unit	Value guaranteed by the bidder
1.	Name of manufacturer		
2.	Address of manufacturer		
3.	Dimensioned drawings of insulator strings enclosed		
4.	Detailed dimensional drawings of all hardware components enclosed		
5.	Material of all components indicated in drawings		
6.	Maximum magnetic power loss of suspension assembly at conductor current of 350 Ampere	Watts	
7.	Slipping strength of suspension assembly (clamp torque Vs slip curve shall be enclosed	KN	
8.	Particulars of standard / AGS preformed armour rod set for suspension assemble		
	(a) No. of rods per set	No.	
	(b) Direction of lay		
	(c) Overall length after fitting on conductor	mm	

SCHEDULE – B1
Bidder's Name
……
Specification No. ……..

Sr. No	Description	Unit	Value guaranteed by the bidder
	(d) Actual length of each rod along its helix	mm	
	(e) Diameter of each rod	mm	
	(f) Tolerance in		
	(i) Diameter of each rod	mm	
	(ii) Length of each rod	mm	
	(iii) Difference of length between the longest and shortest rod in a set	mm	
	(g) Type of Aluminum alloy used for manufacture of PA rod set		
	(h) UTS of each rod	Kg / mm^2	
9.	Particulars of Elastomer (For AGS Clamp only)		
	(a) Supplier of elastomer		
	(b) Type of elastomer		
	(c) Shore hardness of elastomer		
	(d) Temperature range for which elastomer is designed		
	(e) Moulded on insert		
10.	Total weight of Assembly		
	(a) Single Suspension	Kg.	
	(b) Single Suspension 'pilot'	Kg	
	(c) Double Suspension	Kg	
11.	UTS of string hardware		
	(a) Single Suspension	KN	
	(b) Single Suspension 'pilot'	KN	
	(c) Double Suspension	KN	
12.	Purity of Zinc used for galvanizing	%	

SCHEDULE – B1
Bidder's Name

……

Specification No. ……

Sr. No	Description	Unit	Value guaranteed by the bidder
13.	Min. No. of dips in standard piece test, the ferrous parts can withstand	No.	
14	Design calculations for yoke plates enclosed		

Date

(Signature)

Place

(Printed Name)

(Designation)

(Common Seal)

SCHEDULE – B2
Bidder's Name
…….
Specification No. ……..….

GUARANTEED TECHNICAL PARTICULARS OF TENSION HARDWARE FITTINGS (SUITABLE FOR ACSR 'ZEBRA' CONDUCTOR)

Sr. No	Description	Unit	Value guaranteed by the bidder
1.	Name of manufacturer		
2.	Address of manufacturer		
3.	Dimensioned drawings of insulator strings enclosed		
4.	Detailed dimensional drawings of all hardware components enclosed		
5.	Material of all components indicated in drawings		
6.	Electrical resistance of dead end assembly	Ohms	
7.	Slip strength of dead end assembly	KN	
8.	Total weight of Assembly (a) Single Tension (b) Double Tension	 Kg. Kg	
9.	UTS of string hardware (a) Single Tension (b) Double Tension	 KN KN	
10.	Purity of Zinc used for galvanizing	%	
11.	Min. No. of dips in Standard Preece Test, the ferrous parts can withstand	No.	

Date
Place

Signature
Name
Designation
Company Seal

SCHEDULE – B3
Bidder's Name
……..
Specification No. ……..….

GUARANTEED TECHNICAL PARTICULARS OF INSULATOR STRINGS (WITH DISC INSULATORS) ALONGWITH HARDWARE FITTINGS

Sl. No.	Description	Unit	Single Suspension 1x14	Double Tension 2x15	Single Tension 1x15	Double Suspension 2x14	Single Suspension 'Pilot' 1x14
1.	Power frequency withstand voltage of string with arcing horns under wet condition.	kV (rms)					
2.	Impulse withstand voltage (dry)						
	(a) Positive	KV(peak)					
	(b) Negative	KV(peak)					
3.	Impulse flashover voltage (dry)						
	(a) Positive	KV(peak)					
	(b) Negative	KV(peak)					
4.	Mechanical strength of complete insulator string along with hardware fittings	KN					
5.	Maximum voltage distribution across any disc of line to earth voltage	%					
6.	Dimensioned drawings of insulator strings enclosed	Yes / No					

Date

Place

(Signature)

(Printed Name)

(Designation)

(Common Seal)

SCHEDULE – B4
Bidder's Name
…….
Specification No. ……..….

PARTICULARS OF MID SPAN COMPRESSION JOINT FOR ACSR 'ZEBRA' CONDUCTOR

			ZEBRA
1.	Manufacturer's Name & Address		
2.	Drawing enclosed		
3.	Suitable for conductor size	(mm)	
4.	Purity of aluminum used for aluminum sleeve		
5.	Material for steel sleeve		
	(i) Type of material with chemical composition		
	(ii) Hardness of material (Brinnel Hardness)		
	(iii) Weight of zinc coating	(gm/m^2)	
6.	Outside diameter of sleeve before compression		
	(a) Aluminum	(mm)	
	(b) Steel	(mm)	
7.	Inside diameter of sleeve before compression		
	(a) Aluminum	(mm)	
	(b) Steel	(mm)	
8.	Length of sleeve before compression		
	(a) Aluminum	(mm)	
	(b) Steel	(mm)	
9.	Dimensions of sleeve after compression		
	(a) Aluminum		
	(i) Corner to corner	(mm)	
	(ii) Surface to surface	(mm)	
	(b) Steel		
	(i) Corner to corner	(mm)	
	(ii) Surface to surface	(mm)	
10.	Length of sleeve after compression		
	(a) Aluminum	(mm)	
	(b) Steel	(mm)	

11.	Weight of sleeve	
	(a) Aluminum	(Kg)
	(b) Steel	(Kg)
	(c) TOTAL	(Kg)
12	Slipping strength	(kN)
13.	Conductivity of the compressed unit expressed as percentage of the conductivity of equivalent length of bare conductor	%

Date

(Signature)

Place

(Printed Name)

(Designation)

(Common Seal)

SCHEDULE – B5
Bidder's Name
……..
Specification No. …….

PARTICULARS OF REPAIR SLEEVE FOR ACSR 'ZEBRA' CONDUCTOR

1. Manufacturer's Name & Address

2. Drawing enclosed

3. Suitable for conductor size (mm)

4. Purity of aluminum (%)

5. Inside diameter of sleeve before compression (mm)

6. Outside dimensions of sleeve
   (a) Dia before compression (mm)
   (b) After compression
      (i) Corner to corner (mm)
      (ii) Surface to surface (mm)

7. Length of sleeve
   (a) Before compression (mm)
   (b) After compression (mm)

8. Weight of sleeve (Kg)

Date

(Signature)

Place

(Printed Name)

(Designation)

(Common Seal)

SCHEDULE – B6
Bidder's Name
……
Specification No. …….

PARTICULARS OF MID SPAN COMPRESSION JOINT FOR GALVANIZED STEEL EARTHWIRE (7 / 3.15 mm)

1. Manufacturer's Name & Address

2. Drawing enclosed

3. Material of joint
   (i) Type of material with chemical composition
   (ii) Hardness of the material (Brinnel hardness)

4. Inside diameter of sleeve before compression (mm)
   (i) Steel sleeve (mm)
   (ii) Aluminum sleeve (mm)
   (iii) Aluminum filler sleeve (mm)

5. Outside diameter of sleeve
   (a) Steel sleeve (mm)
   (b) Aluminum filler sleeve (mm)

6. Outside diameter of sleeve after compression
   (a) Steel sleeve
      (i) Corner to corner (mm)
      (ii) Surface to surface (mm)
   (b) Aluminum cover
      (i) Corner to corner (mm)
      (ii) Surface to surface (mm)

7. Length of steel sleeve
   (a) Before compression (mm)
   (b) After compression (mm)

8. Length of Aluminum sleeve
   (a) Before compression (mm)
   (b) After compression (mm)

9. Weight of sleeve

	(a) Steel	(Kg)
	(b) Aluminum	(Kg)
	(c) Filler Aluminum sleeve	(Kg)
10.	Slipping strength	(kN)
11.	Conductivity of the compressed unit expressed as a percentage of the conductivity of equivalent length of bare earthwire	(%)

Date

(Signature)

Place

(Printed Name)

(Designation)

(Common Seal)

SCHEDULE – B7
Bidder's Name
……..
Specification No. ……..….

PARTICULARS OF VIBRATION DAMPER FOR ACSR 'ZEBRA' CONDUCTOR

1.	Manufacturer's Name & Address	
2.	Drawing enclosed (a) Design drawing (b) Placement chart	
3.	Suitable for conductor size	(mm)
4.	Total weight of one damper	(Kg)
5.	Diameter of each damper mass	(mm)
6.	Length of each damper mass	(mm)
7.	Weight of each damper mass	(Kg)
8.	Material of damper masses	
9.	Material of the stranded messenger cable	
10.	Number of strands in stranded messenger cable	
11.	Lay ratio of stranded messenger cable	
12.	Minimum ultimate tensile strength of stranded messenger cable	(Kg / mm^2)
13.	Slipping strength of stranded messenger cable (mass pull off)	(KN)
14.	Resonance frequencies (a) First frequency (b) Second frequency	 (Hz) (Hz)
15.	Designed clamping torque	(Kg-m)
16.	Slipping strength of damper clamp	

(a) Before fatigue test
(b) After fatigue test

17. Magnetic power loss per vibration damper at a conductor current of 350 Ampere (watts)

18. Material of Clamp

Date

(Signature)

Place

(Printed Name)

(Designation)

(Common Seal)

SCHEDULE – B8
Bidder's Name
……..
Specification No. ……..….

PARTICULARS OF VIBRATION DAMPER FOR GALVANIZED STEEL EARTHWIRE

1.	Manufacturer's Name & Address	
2.	Drawing enclosed (a) Design drawing (b) Placement chart	
3.	Suitable for earthwire size	(mm)
4.	Total weight of one damper	(Kg)
5.	Diameter of each damper mass	(mm)
6.	Length of each damper mass	(mm)
7.	Weight of each damper mass	(Kg)
8.	Material of damper masses	
9.	Material of the stranded messenger cable	
10.	Number of strands in stranded messenger cable	
11.	Lay ratio of stranded messenger cable	
12.	Minimum ultimate tensile strength of stranded messenger cable	(Kg / mm^2)
13.	Slipping strength of stranded messenger cable (mass pull off)	(kN)
14.	Resonance frequencies (a) First frequency (b) Second frequency	 (Hz) (Hz)
15.	Designed clamping torque	(Kg-m)

16. Slipping strength of damper clamp
    (a) Before fatigue test
    (b) After fatigue test

17. Material of Clamp

Date

(Signature)

Place

(Printed Name)

(Designation)

(Common Seal)

.

SCHEDULE –B9
Bidder's Name
…….
Specification No. ……..….

PARTICULARS OF SUSPENSION CLAMP FOR GALVANIZED STEEL EARTHWIRE
(7 / 3.15 mm)

1. Manufacturer's Name & Address

2. Drawing enclosed

3. Material
   (i) Shackle
   (ii) Clamp Body & Keeper
   (iii) U – Bolt

4. Total drop (maximum) (mm)

5. Weight (Kg)

6. Breaking Strength (minimum) (Kgf)

7. Slipping Strength (KN)

8. Tightening Torque (kg–m)

Date

(Signature)

Place

(Printed Name)

(Designation)

(Common Seal)

SCHEDULE – B10
Bidder's Name
……..
Specification No. …….

PARTICULARS OF TENSION CLAMP FOR GALVANIZED STEEL EARTHWIRE
(7 / 3.15 mm)

1. Manufacturer's Name & Address

2. Drawing enclosed

3. Material
   (i) Shackle
   (ii) (a) Compression clamp
   (b) Hardness of the material (BHN)

4. Inside diameter of the clamp before compression (mm)

5. Outside dimensions of clamp
   (a) Before compression (mm)
   (b) After compression
   (i) Corner to corner (mm)
   (ii) Surface to surface (mm)

6. Length of clamp
   (a) Before compression (mm)
   (b) After compression (mm)

7. Weight (Kg)

8. Slip strength (minimum) (kN)

9. Compression Pressure (T)

10. Minimum breaking strength of assembly (excluding clamp) (kgf)

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

SCHEDULE – B11
Bidder's Name
……
Specification No. ……..….

PARTICULARS OF FLEXIBLE COPPER BOND

1.	Manufacturer's Name & Address	
2.	Drawing enclosed	
3.	Stranding	
4.	Cross sectional area	Sq.mm
5.	Minimum copper equivalent area	Sq.mm
6.	Length of copper cable	mm
7.	Material of lugs	
8.	Bolt Size	
	(i) Diameter	mm
	(ii) Length	mm
9.	Resistance	ohm
10.	Total weight of flexible copper bond	kg

Date
Place

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

FORMAT FOR SUBMISSION OF PROGRESS REPORT

(This format is in addition to the daily and weekly progress reports with respect to the PERT charts)

NAME OF FIRM:
CONTRACT NO.:
Particulars of line (Viz, Name, Length & Target dates etc.)
Progress Report for the fortnight ending

S L N O	Particulars of Work	Unit	Total Qty.	Work done till last report	Work done material received during fortnight	Cum ulati ve Total	Planning for next fortnight	Remarks & Bottleneck if any
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
1.	Detailed Survey	Route Km						
2.	Check Survey	Route Km						
3.	Excavation Stub Setting Conreting & Backfilling (i) A Type Tower (ii) B type Tower (iii) C Type Tower	 Nos. Nos. Nos.						
4.	Tower Erection (i) A Type Tower (ii) B type Tower (iii) C Type Tower	 Nos. Nos. Nos.						
5.	Stringing including hoisting insulators, conductor/earthwire accessories Vibration Dampers etc. (i) Final Stringing of conductor (ii) Final Stringing of earth wire	 Km Km.						
6.	Earthing of Tower	Nos.						
7.	Revetment of Tower	Nos.						

8.	Material receipt position (i) Towers & Tower Accessories (ii) Bolt & Nuts (iii) Conductor (iv) Insulators (v) Earthwire (vi) Insulator Hardware a) Suspension b) Tension (vii) Conductor Accessories a) Mid span joint b) Vibration Dampers c) Repair sleeves (viii) Earthwire Accessories a) Suspension Clamp b) Tension Clamp c) Mid span Joint d) Vibration dampers (ix) Earthing Devices (x) Insulators	Nos./ MT Nos. Nos.							
9.	Status of Clearances (i) Right of way (ii) Forest (iii) Railways							
10	Final Checking							

SCHEDULE ' T '

Tender Specification No:- _____

Sl.No.	Name of Bought Out Items	Proposed Vendors
1	2	3

Signature of Bidder ……..

Name of Bidder :

Seal of the Company

Designation :

Address : ……

PRE-QUALIFICATION DETAILS OF BIDDER

1. EXPERIENCE

Sl.No.	DETAILS OF LINES CONSTRUCTED				
	Name of Line	Length	Period of Completion	Performance	Remark
1.	2.	3.	4.	5.	6.

2. TESTING FACILITIES AVAILABLE WITH HIS SUPPLIER (FABRICATER)

Sl No.	Name of Test	Detail of testing equipment available	Range upto which test can be performed	Place of testing
1	2	3	4	5

i) Routine Test
a)
b)
c)

ii) Acceptance Test
a)
b)
c)

Signature of Bidder

Full name:

SCHEDULE FOR SUBMISSION OF DRAWINGS BY THE BIDDER

Sl. No.	Set of Drawings	Date
1.	**Line Profile, Foundation classification**	**March. 2009**
2.	**Tower Design**	**N.A.**
3.	**Foundation Design**	**N.A.**
4.	**Hardware Fittings for Conductor , Earth wire**	**April 2009**
5.	**Tower Accessories**	**April 2009**
6.	**Conductor , E/W & OPGW accessories**	**April 2009**